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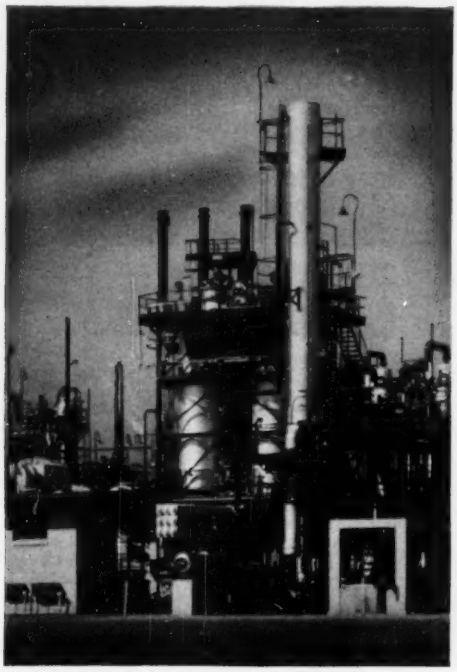
Chemical Engineering

FEBRUARY 1956

DESIGNING



FOR SERVICE LIFE

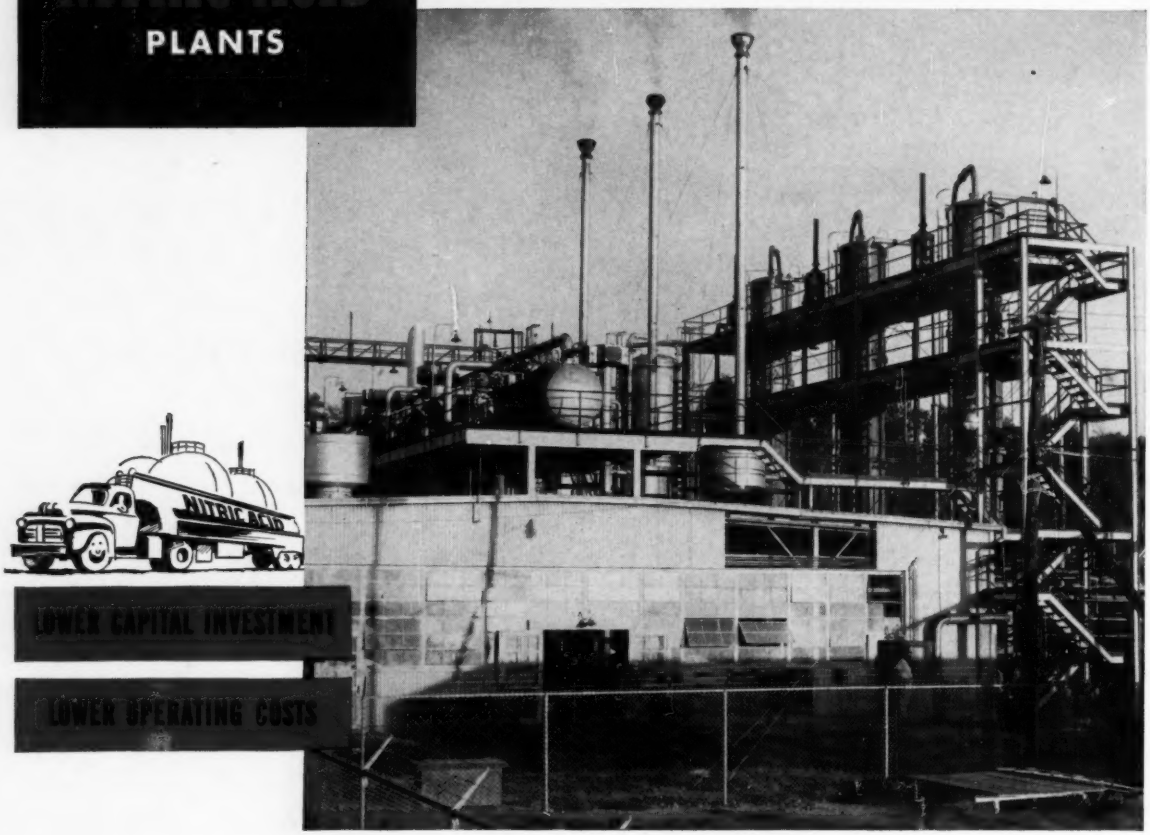
– P. 187

THE WHAT AND WHY OF SUBMERGED COMBUSTION – P. 163

HOW TO PASS YOUR LICENSING EXAMINATION – P. 208

NITRIC ACID PLANTS

Girdler nitric acid plants employ the well-known Du Pont process, using high-pressure catalytic oxidation, to produce nitric acid. These plants offer greater economy, in both investment and operating costs, than atmospheric or low-pressure units. With the high-pressure process 55%-60% nitric acid is produced with efficient use of catalysts, and with lower utility requirements.



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LOWER OPERATING COSTS

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WHEN you come to Girdler for nitric acid facilities, you get the benefit of the vast experience of DuPont as well as Girdler. DuPont's agreement with Girdler has combined the know-how of both companies. Moreover, Girdler has unsurpassed experience in building plants for the production of ammonium nitrate.

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February 1956

GUIDED TOUR

JOHN R. CALLAHAM, EDITOR

Chemical Engineering
FEBRUARY 1956
DESIGNING
FOR SERVICE LIFE
- P. 210
THE WHAT AND WHY OF SUBMERGED COMBUSTION - P. 163
HOW TO PASS YOUR LICENSING EXAMINATION - P. 208

Whenever you design, remember the maintenance problem and save money.

And that's a promise. Spend a few hours checking for inaccessible surfaces, sharp edges and other places on Author Kirtley's list. Design them out of your plant. And design out, too, the spots where poor application and material deficiencies will hike the high costs of maintenance painting. The principles apply to equipment and facilities. Use them to design longer service life into your plant. (p. 187)

Like a blowtorch under water.

Submerged combustion is bringing its talents successfully onto the chemical and chemical process stage. Check our report and find out whether or not it will give you a competitive edge too. (p. 163)

Attack on pressure problems.

More and more, we're leaving the simple inexact formulas used in pressure vessel

Please turn page

18 Editors, 43 Societies

CE's engineer-editors talk the same language as CE's readers.

They've studied under the same professors, worked for the same companies, met the same types of problems in industry. They belong to the same professional societies, go to the same technical meetings.

As specialists within their assigned fields, CE's engineer-editors are active in virtually every professional and industry organization within the fields of chemical engineering and the chemical process industries.

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What's more, our editors have held at one time or another a top or near-top position in virtually every leading association in our field.

CE editors believe in being closely — and actively — associated with the people and industries they serve.—JRC

GUIDED TOUR

design. Take a look at this rapid graphical method for flat heads—and save with minimum safety factors. (p. 171)

To separate those binary mixtures.

Here's a new whack at the old bugaboo of getting equilibrium diagrams. It's a new chart that can eliminate most of your calculations. And it easily accounts for changes in volatility. (p. 168)

Barometric condensers: A to Z.

In nine pages we've made a giant step for you toward filling a hiatus in the literature. Now you've got authoritative dope on the barometric condenser: design, principles and applications. (p. 174)

Expensive metals vs. extreme conditions.

With this combination, you must know how far you can go. You can now recheck your thinking about unsteady state heat flow and analyze transient problems—nuclear reactors, for example. (p. 183)

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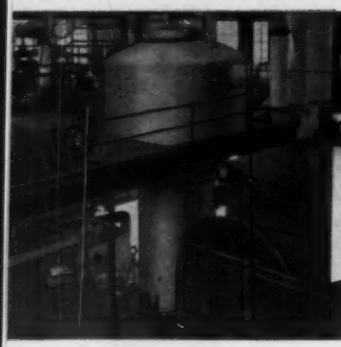
"But ..."



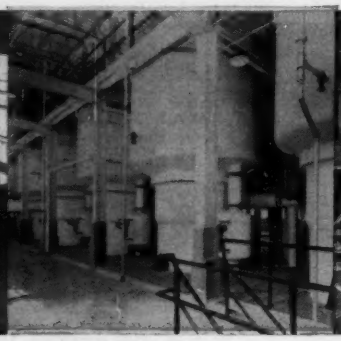
Long-tube, First-effect Pressure Evaporator operating on sugar juice, converting existing quadruple-effect to quintuple-effect.

Swenson Multiple-body, Quintuple-effect, Long-tube, vertical evaporator in a kraft paper mill.

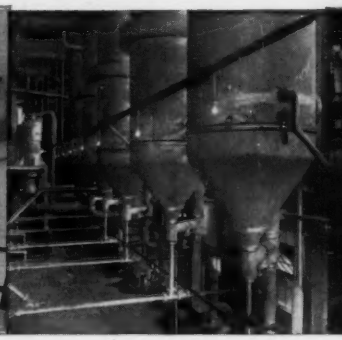
A Swenson Spray Dryer used in a Distillery, handling distillers' solubles.

Every Spray Drying and Evaporating

Swenson Forced Circulation Evaporators used for concentration of viscous, salting and scaling liquors.



Swenson Quintuple-effect Evaporator used in the processing of beet sugar.



World's largest black liquor evaporator installation—a multiple-effect with more than a half-million pounds of evaporation per hour.

Engineering and Experience are called

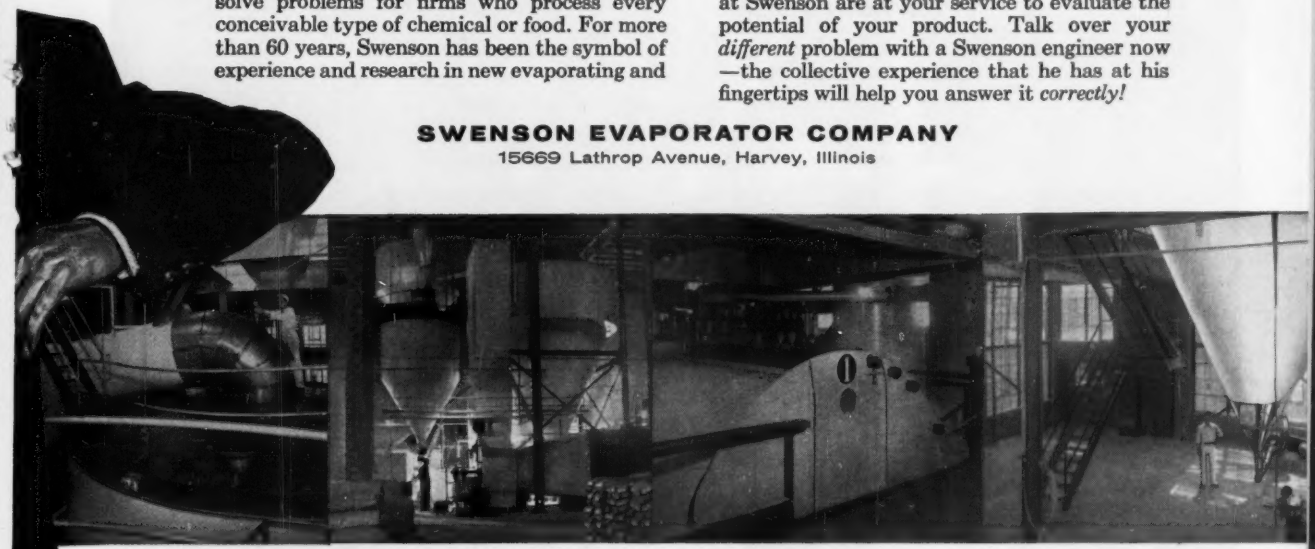
Write Today for Information!

Get the complete Swenson Catalog . . . contains full information on long-tube vertical evaporator, spray dryers, crystallizers, forced circulation evaporators and recovery equipment for pulp mills such as pulp washers, black liquor evaporators, filters, and blow condensers.

. . . my problem is different !"

Sure, your problem is different! That's the way it is with evaporation and spray drying. Nobody knows *that* better than Swenson Engineers, for every day they are helping to solve problems for firms who process every conceivable type of chemical or food. For more than 60 years, Swenson has been the symbol of experience and research in new evaporating and spray drying techniques. Swenson engineering has made possible lower production costs and the development of new products for new markets. The plant-scale research laboratories at Swenson are at your service to evaluate the potential of your product. Talk over your *different* problem with a Swenson engineer now —the collective experience that he has at his fingertips will help you answer it *correctly!*

SWENSON EVAPORATOR COMPANY
15669 Lathrop Avenue, Harvey, Illinois



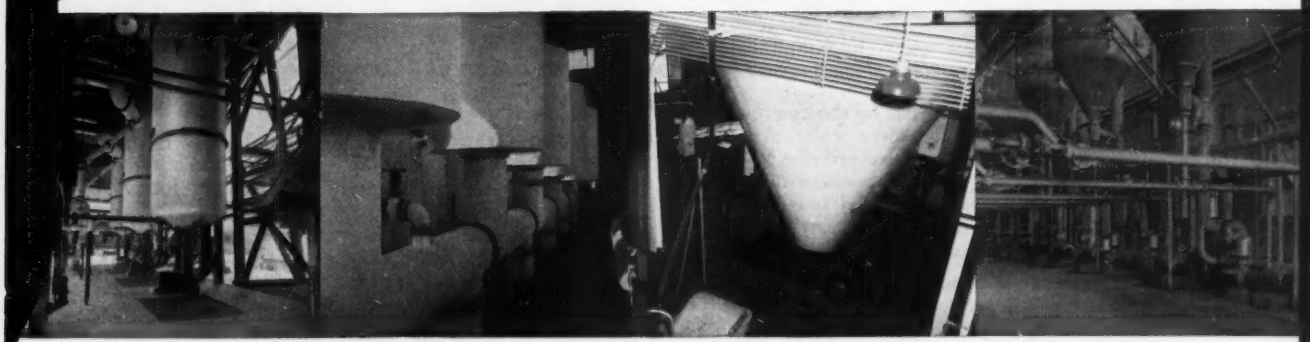
A Swenson Spray Dryer in operation at a large whole milk drying plant.

A gas-heated Swenson Spray Dryer in operation at a chemical processing plant.

Swenson also engineers washers for the pulp industry . . . shown is a single-drum, two-stage washer.

A Swenson Spray Dryer installation used in the production of starch products.

problem is different! That is why...Swenson



Swenson Multiple-effect, Long tube, Vertical Evaporator handling black liquor in a paper mill.

Catchalls and cutout vapor piping for a large Swenson Long-tube, Vertical Evaporator installation.

Lower section of Spray Dryer Chamber in which distillers' dried solubles are produced.

Swenson Multiple-effect, Quintuple-effect, Long-tube, Vertical Evaporator used for kraft mill black liquor.

upon by Industries everywhere. Remember ...

SWENSON

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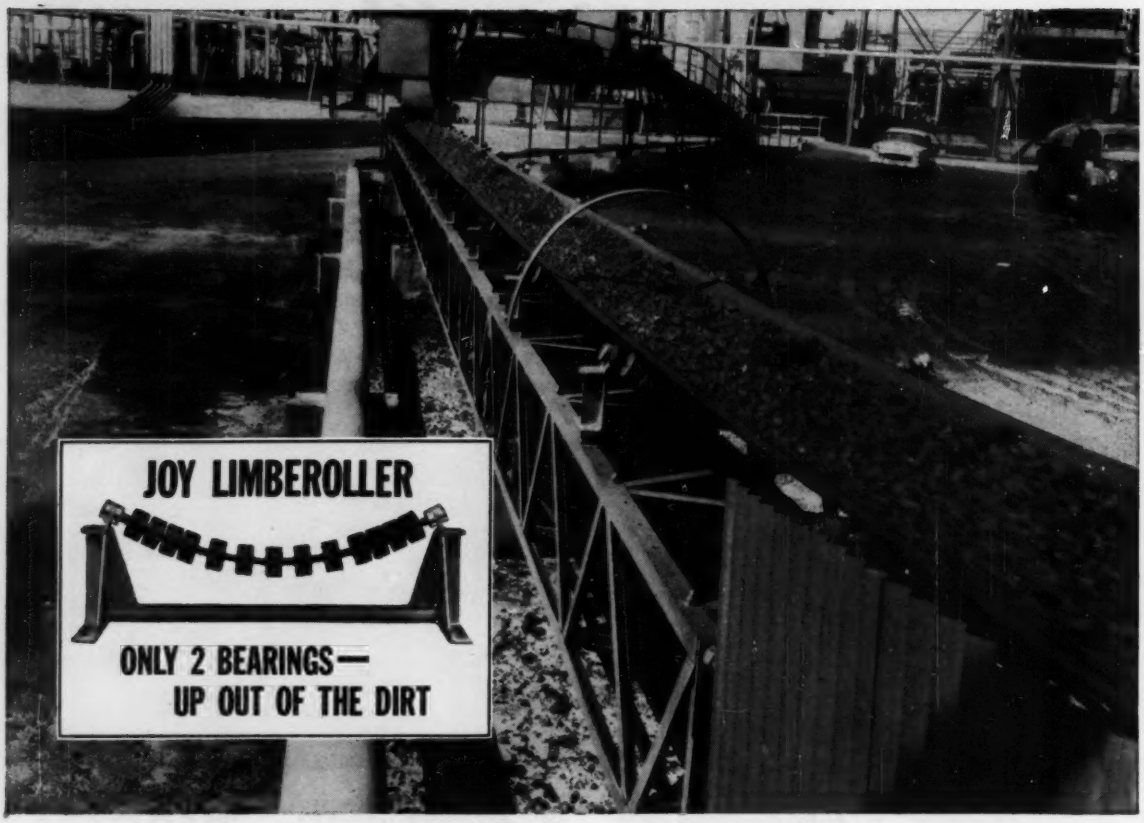
Since 1889

A Division of WHITING Corporation



Here's the Conveyor Idler that fights abrasion or corrosion- *AND LASTS!*

Joy Limberollers . . . neoprene discs molded on flexible steel cables . . . eliminate a tough, tricky belt-conveyor problem at Union Oil Company:

PETROLEUM COKE, as handled by the conveyor at Union Oil Company, contains some water. At times there is sufficient free water in the mixture to form slurry. Handling this slurry was a problem since the coke and water could splash out and foul the idler bearings. Spilling . . . generally caused by belt bumping . . . was avoided by using flexible Joy *Limberollers.*

FEWER IDLERS were needed with solution of the bumping problem and, as a result, Joy *Limberollers* were spaced on 6′ centers instead of the usual 4′ centers.

NO BEARING CLOGGING was encountered because Joy *Limberollers* have no bearings under the belt (the trouble spot on conventional steel idlers). In fact, there are only *two* bearings on each Joy idler and these are up out of the dirt zone and sealed against dust.

TEN TIMES LONGER LIFE over that of conventional idlers is not unusual with Joy *Limberollers* on abrasive or corrosive jobs. Witness the magnesium foundry where Joy *Limberollers* have operated since February 1953 . . . and are still going strong! Compare this to the three-month life of the conventional idlers formerly used . . . *then figure the saving!*

For details on this *new* solution to an old belt-conveyor problem, write to **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 42-11

It gives complete information on the unique Limberoller Idler, and we'll be glad to supplement it with engineering assistance on your particular problem.

Consult a Joy Engineer

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Kansas City, Missouri

4027 stock items

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Remember **FLOWLINE®** WELDING FITTINGS

Forget **CORROSION** PIPING PROBLEMS

W-8

KNOW THE RIGHT FILTER IN ADVANCE

BIRD RESEARCH AND DEVELOPMENT CENTER
TEST REPORT No. 4093
Dates: January 4, 5, 6, 1956
Company: Blank Mining Co.
Blankton, Montana
Material: Uranium Ore
Problem: Dewater and wash 2000 tons per day. Three washes, each ½lb. water per lb. solids
Sample:
Amt. Three 30-gallon drums
Slurry: Viscosity 100 Sp. gr. 1.50 pH 2.0 Temp. room
Solids: See attached screen analysis
Size: MAX 35 mesh
Feed: to contain 45.0% solids
Description of test: The material as received was diluted by tap water to a consistency of

BEFORE YOU INVEST A DOLLAR . . .

in equipment, Bird can give you the right answer to the question, "which filter will do the best job for me and do it *profitably?*"

This time-saving, money-saving service is the function of the Bird Research and Development Center, a completely equipped test plant with its own full time crew of experts, devoted exclusively to test work and application development involving solids-liquids separations.

It's yours to use, just as though it were right in your own plant. Make the most of it.

The Main Test Floor of the Bird Research and Development Center provides thirty feet of headroom and lifting facilities for loads up to 6000 lbs. Test engineers are virtually unhampered in the type and volume of materials that can be handled and in the range of temperature, vacuum and power at their disposal.

BIRD
MACHINE COMPANY

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Builders of: BIRD CONTINUOUS SOLID BOWL CENTRIFUGAL FILTERS
BIRD SCREEN TYPE CENTRIFUGAL FILTERS
BIRD-PRAYON CONTINUOUS, ROTARY, HORIZONTAL VACUUM FILTERS
BIRD-YOUNG ROTARY VACUUM FILTERS
BIRD PRESSURE FILTERS • BIRD COAL FILTERS • BIRD POLISHERS
BIRD-HUMBOLDT SCREEN TYPE CENTRIFUGAL DRYERS
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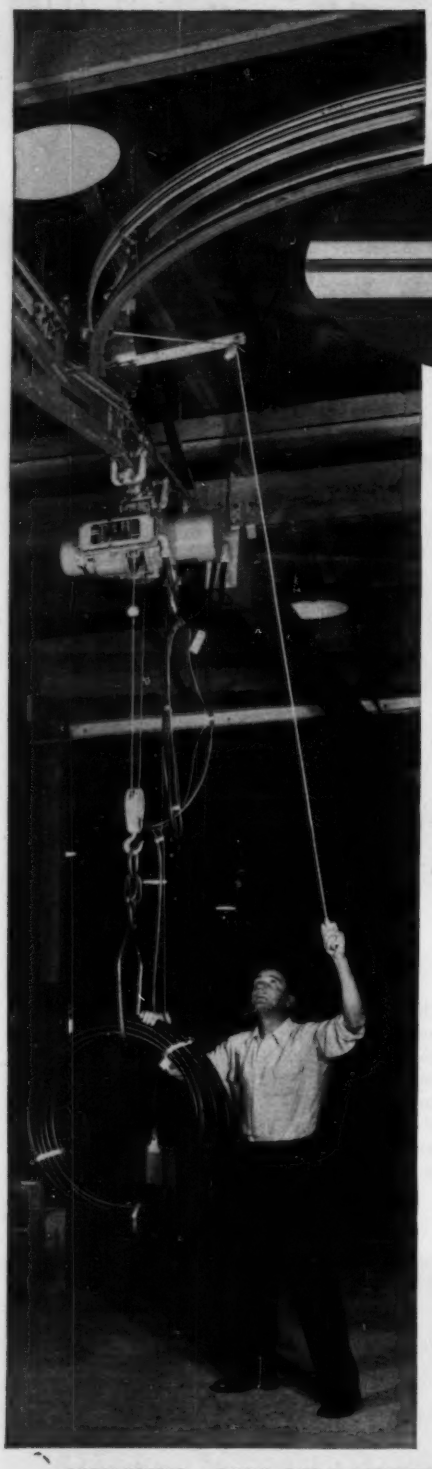
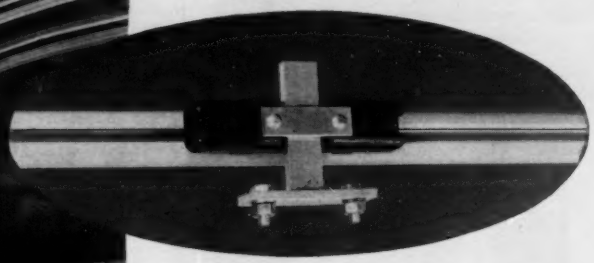
SOUTH WALPOLE • MASSACHUSETTS
Regional Offices: Evanston, Illinois • Portland, Oregon

Another new development using

B. F. Goodrich Chemical *raw materials*



B. F. Goodrich Chemical Company does not manufacture this extrusion. We supply only the Geon rigid vinyl materials.



Rigid Geon packs power in small space

NAKED wires on an overhead power lift are a hazard, lose power along the line and have to be spaced widely where multiple electrical contacts are needed in large plants. As a product improvement, a manufacturer has designed U-shaped extruded insulation made of Geon rigid vinyl that has many advantages for the job.

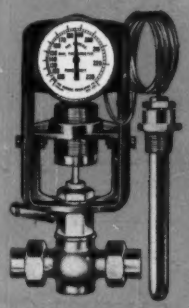
The rigid vinyl extrusion carries a metal contact conductor safely so that as many as three to twelve power lines can be installed close together where space is tight. Because this insulation is made of Geon rigid vinyl it has high dielectric strength, high insulation resistance with low power loss. It has good chemical and abrasion resistance, necessary for long life in industrial plants and it can be colored according to local code requirements.

This installation you see here is a good example of a new use for Geon rigid vinyl. It may suggest a new use to you or may give you an idea for another saleable product. There are scores of other uses for Geon materials from rigid sheeting to rigid pipe and fittings. For technical help in the uses of versatile Geon please write Dept. DB-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

WHY POWERS No. 11 REGULATORS Give BETTER CONTROL and Last Longer



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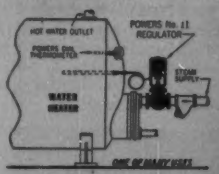


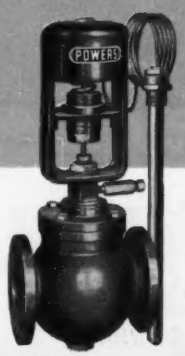
SELF OPERATING Needs no Electricity.

Better TEMPERATURE Control results from powerful bellows and minimum of valve stem friction. Valve Stem Lubricator aids easy movement of valve stem without binding. Double ply metal used in Powers bellows outlasts ordinary single ply type.

Balanced (Double Seat) Valve

Controls Flow of Steam, Water or Gas

EASY TO INSTALL bronze union connections for single and double seat valves thru 2" save installation time and labor.



(c44)

Above: Flanged Iron Body Valve with Double Seat for sizes above 2"

● **15 to 20 Years of reliable service** is often reported by users of Powers Temperature Regulators. Since 1891 they have been noted for their sturdy construction and dependability.

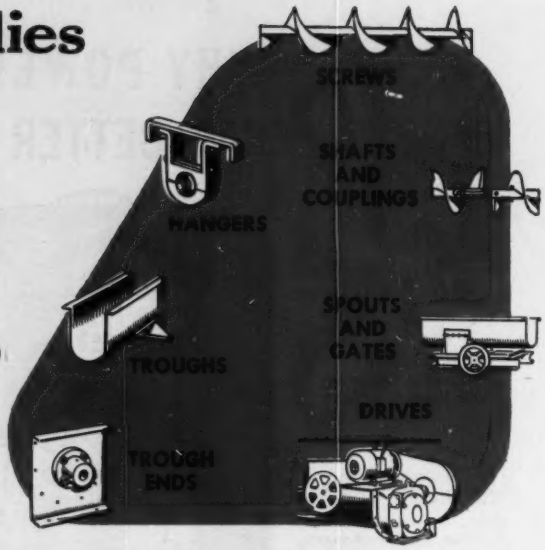
● Right type of Regulator and the right size valve is important for best control. From Powers complete line of self operating regulators and air operated temperature controllers you can be sure of getting the type best suited for your requirements. Call our nearest office or write us direct. 3400 Oakton St., Skokie, Illinois. Offices in Chief Cities.

POWERS CONTROL

Since 1891

THE POWERS REGULATOR COMPANY

How Link-Belt applies STANDARD or SPECIAL screw conveyors to meet your needs



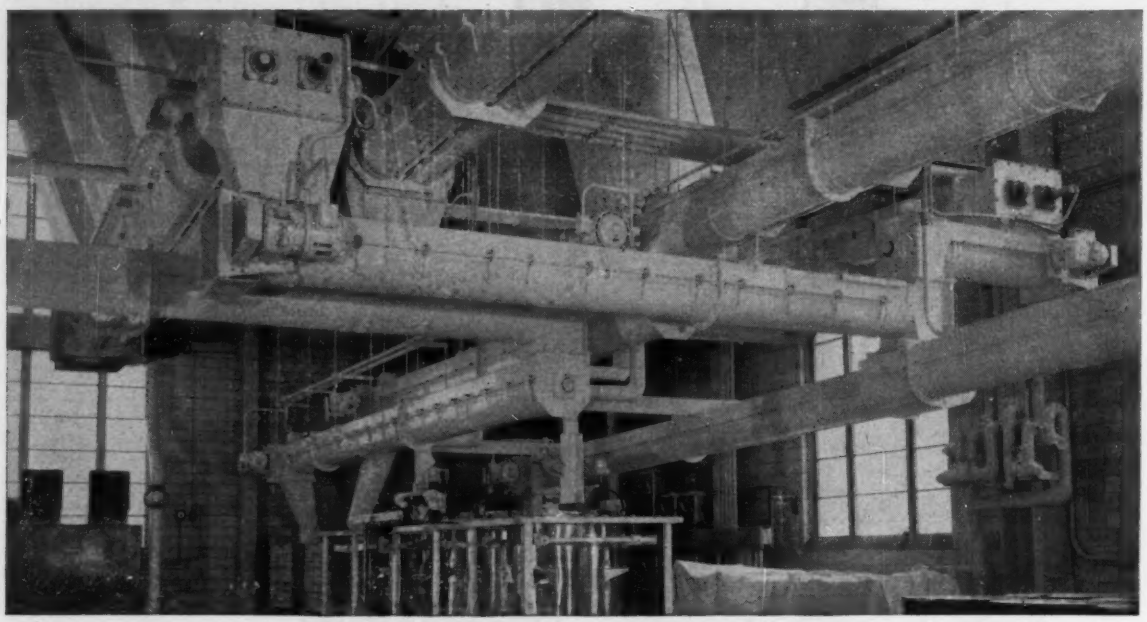
This 4-phase service saves you time . . . spares you details

ANALYSIS AND ENGINEERING service is provided by a district sales office in your area. From long experience, Link-Belt District Engineers can quickly ascertain the best conveying arrangement for you.

COMPLETE LINE OF SCREW CONVEYOR COMPONENTS and related elevating, conveying and power transmission equipment is your assurance that specific needs are fulfilled efficiently and economically.

EASY ERECTION is achieved because of pre-fitting, match marking, close-tolerance manufacturing and Link-Belt drawings. Link-Belt will handle erection if you wish.

SATISFACTORY PERFORMANCE is assured when you rely on Link-Belt as a single contract source for your complete system. We will accept full responsibility for placing it in operating readiness.



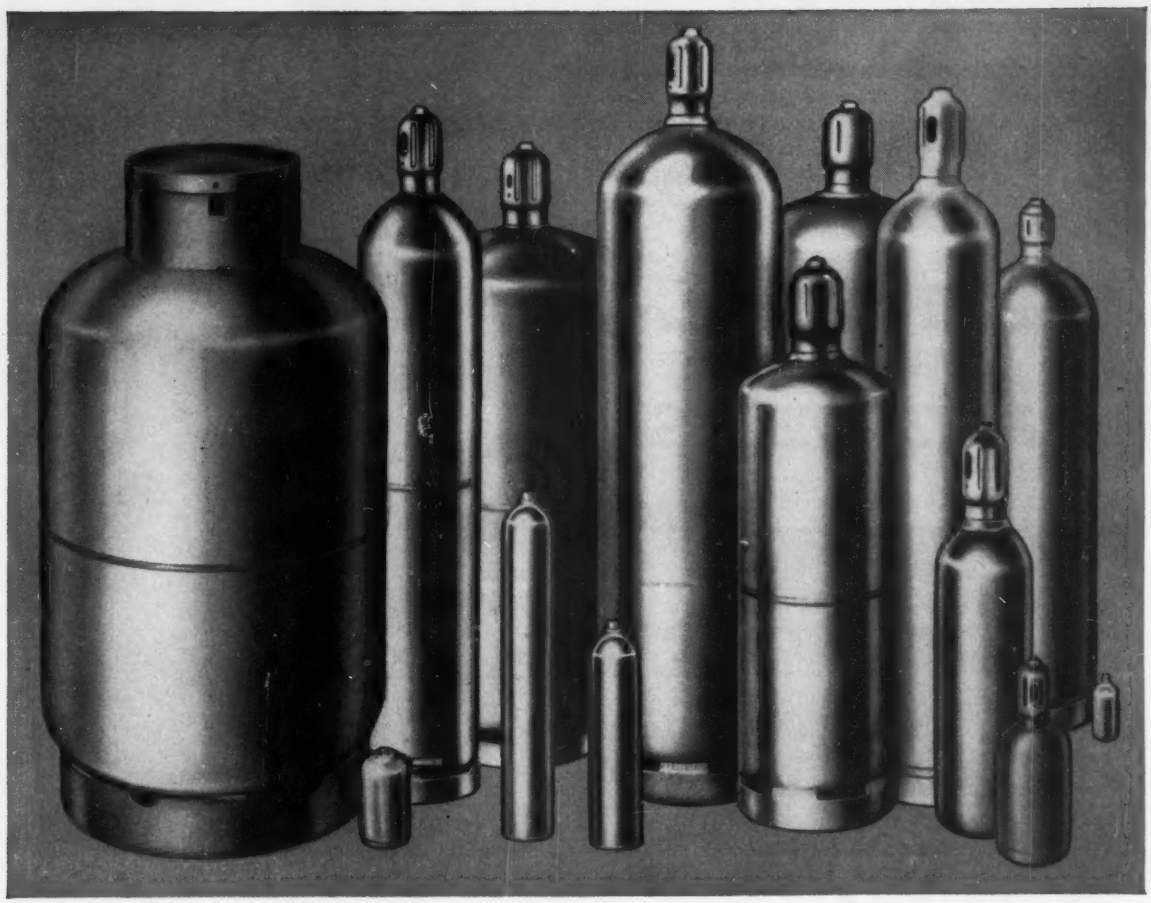
At Midwest bakery, Link-Belt twin screw feeders and screw conveyors provide sanitary handling of sugar and flour to bins and sifters.

Extensive engineering experience has provided Link-Belt with standard solutions to specialized screw conveying requirements. In addition, local availability of Link-Belt engineering service and quality components assures prompt, efficient action. That's why—whether you plan a complete new system or improvement of present arrangements—a call to your nearest Link-Belt office is a sure step to lower handling costs.

LINK-BELT

SCREW CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 12,912



In all sizes . . . for all compressed gases Hackney seamless or two-piece cylinders

Hackney compressed gas cylinders are designed with low tare weight for easy handling and freight-saving shipping—either empty or filled. Yet adequate strength is always assured by the use of selected, high-grade steel. The Hackney manufacturing process draws the side walls to uniform thickness that eliminates unnecessary weight.

Hackney cylinders are uniform in size and weight—uniformly easy to handle—uniformly durable for long service with the busy chemical shipper. Made in many sizes—for high-pressure or low-pressure shipment of all types of gases. Write today for full details.

Hackney cylinders are regularly furnished for shipping compressed gases such as:

Argon	Chloropicrin
Anhydrous Ammonia	Helium
Chlorine	Hydrocyanic Acid Gas
Refrigerant Gases	Sulphur Dioxide
Butane and Propane	Sulphur Hexafluoride
Carbon Dioxide	Anhydrous Hydrogen Chloride
Oxygen	Boron Trifluoride
Methyl Bromide	*—and many, many others*
Nitrogen	

Hackney MILWAUKEE — DOWNINGTOWN IRON WORKS

Pressed Steel Tank Company

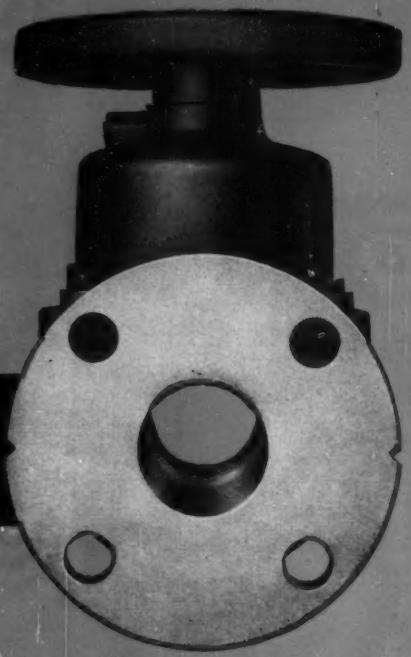
1447 South 66th Street, Milwaukee 14, Wisconsin • *Manufacturer of Hackney Products*

52 Vanderbilt Avenue, Room 2025, New York 17, N.Y. • 203 Hanna Bldg., Cleveland 15, Ohio • 936 W. Peachtree St., N.W., Room 113, Atlanta 3, Ga. • 208 S. LaSalle St., Room 792, Chicago 4, Ill. • 553 Roosevelt Bldg., Los Angeles 17, Calif. • 4550 Main St., Room 206, Kansas City 6, Mo. • 140 Wallace Ave., Downingtown, Pa.

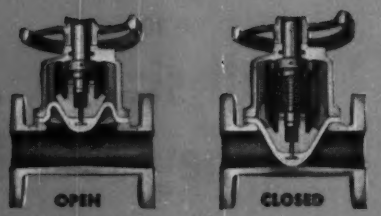
CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

Announcing...
the new,
exclusive

GRINNELL-SAUNDERS STRAIGHTWAY DIAPHRAGM VALVE



...the diaphragm valve with STRAIGHT-THROUGH FLOW, for handling viscous materials, fibrous slurries, sludges, pulp stock, latex, magmas, semi-fluid foods, solids in suspension, sewage, water, corrosive chemicals



Diaphragm lifts high for streamline flow in either direction. No pockets to trap sludge

Diaphragm presses tight for positive closure even when handling gritty or fibrous materials

Grinnell-Saunders STRAIGHTWAY Diaphragm Valve* offers you these exclusive features: the ability to handle viscous materials without restriction or stoppage; minimum pressure drop; rodding or brushing without need of removing bonnet and without possibility of damaging body linings; self-draining when line is pitched sufficiently to drain piping.

Grinnell-Saunders STRAIGHTWAY Diaphragm Valves are available in a range of body, lining and diaphragm materials. Inquiries invited. Bulletin on request.

*Patented

GRINNELL COMPANY, INC.
291 West Exchange St., Providence, R. I.

Kindly send me a complimentary copy of your "Grinnell-Saunders Straightway Diaphragm Valve" bulletin.

Name_____
Title or function_____
Company_____
Address_____
City_____ State_____

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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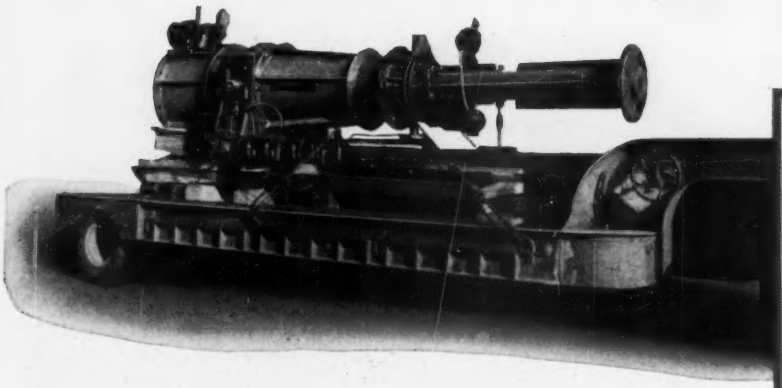
KELLEY
SERVING THE NUCLEAR INDUSTRIES

IN THE FIELD OF RADIATION SHIELDING...
WE HAVE SERVED INDUSTRY FOR OVER 35 YEARS

Lead Radiation Protection is our Specialty...
Manufactured & Installed to suit your specific requirements



RECENT SHIELDING INSTALLATIONS

- USS NAUTILUS
- USS SEAWOLF
- SIR PROTOTYPE WEST MILTON, N. Y.
- MARK I PROTOTYPE ARCO, IDAHO

ATOMIC ENERGY ★ NUCLEAR INDUSTRIES

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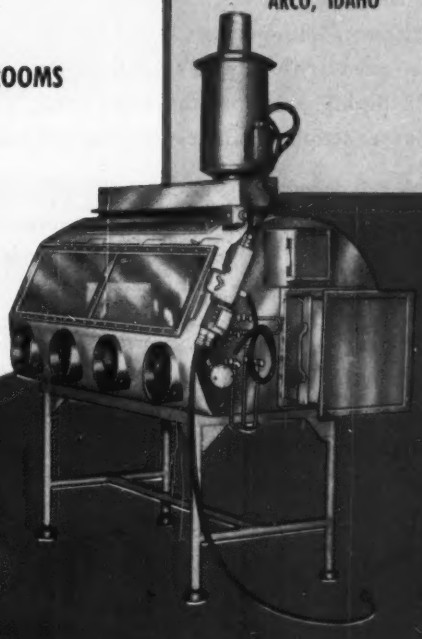
STAINLESS STEEL EQUIPMENT OF INTRICATE DESIGN, FABRICATED TO PRECISE TOLERANCES • YEARS OF EXPERIENCE IN THE A.E.C. FIELD ENABLES US TO MEET YOUR MOST RIGID REQUIREMENTS.



D. W. KELLEY and Company

ENGINEERS DESIGNERS FABRICATORS

BOSTON 22, MASSACHUSETTS

JOHNSON CITY, TENN. CLEVELAND, OHIO NEW YORK, N. Y. PITTSBURGH, PA. HOUSTON, TEXAS

Only Chapman Tilting Disc Check Valves give you

FAST TIGHT QUIET CLOSURE

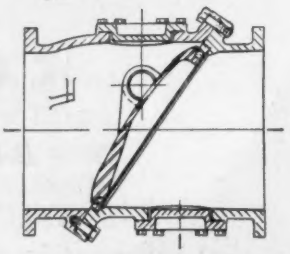
Fast, quiet operation means low cost operation for check valves. That's exactly what the Chapman Tilting Disc Check Valve is designed to do. It won't flutter or slam and damage the piping joints or the valve itself. The unique drop-tight closure action eliminates scraping and wear of the disc and seat.

Rugged construction and low wear of the Chapman Tilting Disc Check Valves mean long life under severe operating conditions. Absence of vibration plus low head loss keep maintenance of the entire piping system at a minimum.

Whether for replacement or for new piping systems, be sure to specify Chapman Tilting Disc Check Valves. They're available in iron and steel for handling fluids or gases under a wide range of pressures. For full data on the complete line, write today. Ask for Catalog 30-A.

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS

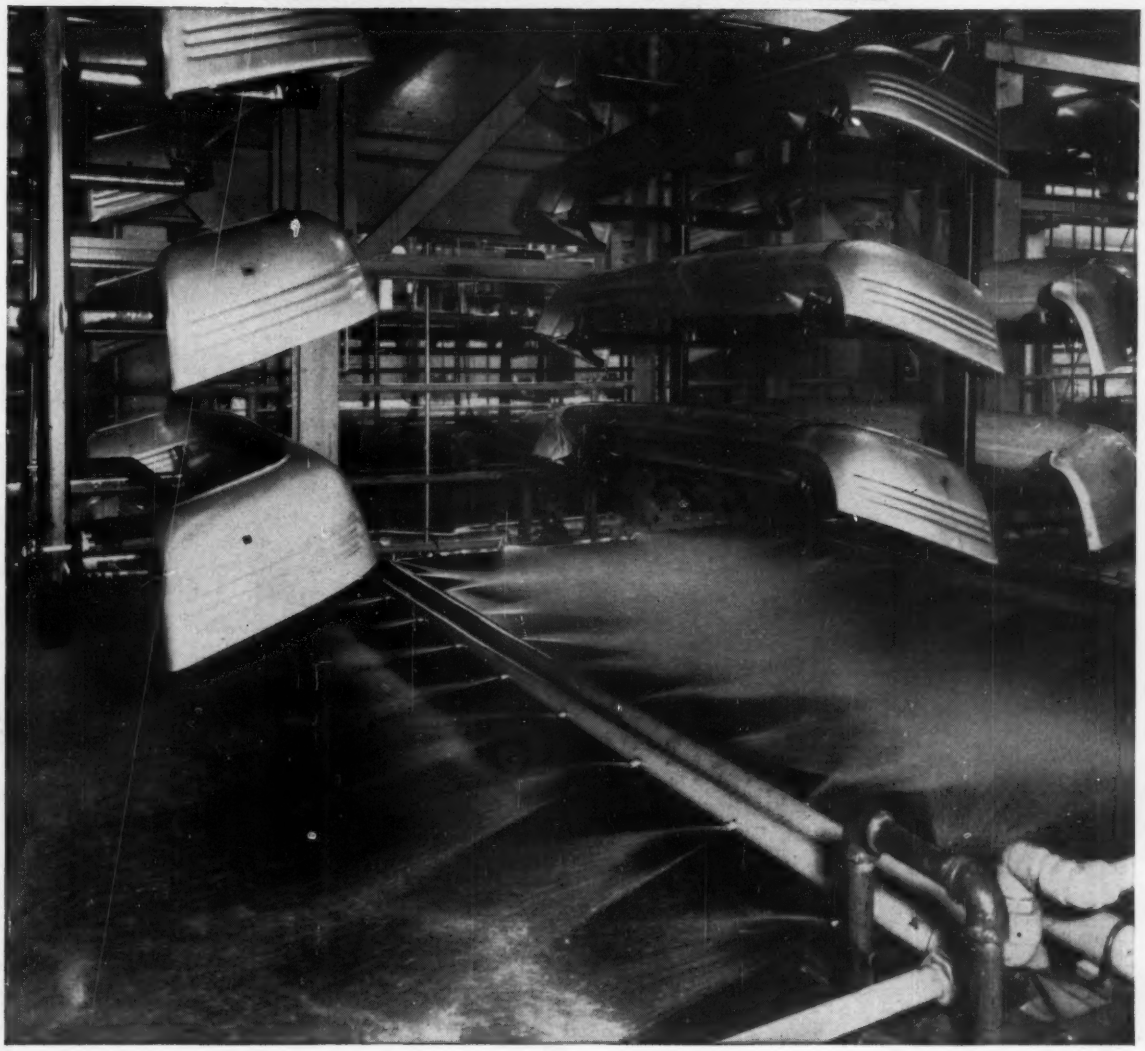
Here's why Chapman's Tilting Disc Check Valves Keep Quiet All of Their Lives



This specially designed "airfoil" disc balances perfectly in open position. The fluid holds the disc tightly against its stops without flutter. The body of the valve is larger around the disc, so the net valve area is at least as much as the pipe area to assure low flow resistance.

When the flow is reversed, pressure against the upper part of the disc cushions it as it closes. Then the disc drops easily and tightly to its beveled seat after the valve has swung closed. Seating is fast and quiet with minimum head loss in all but unusual piping arrangements.

B.F.Goodrich



Shower curtain for an acid bath

A typical example of B.F.Goodrich product development

THEY turn out 360 shiny automobile bumpers an hour by running them through tanks like this. They are being sprayed with acid for cleaning, then dipped in copper, nickel and chrome.

But each of these steps takes a different chemical—acids that would eat through steel or other tank walls, and stop production for costly repairs.

All sorts of lining materials were tried to protect the steel, but nothing could stand up against all these acids until Koroseal came along. Koroseal is a flexible material, developed by B. F. Goodrich, that can stand practically all acids. It was used to line all the tanks in the system, and is working perfectly. No leaks, no repairs, no delays in production.

Today, there are thousands of applications in industry where Koroseal tank linings, belting, hose, tubing, and gaskets are doing jobs better, for less money, than was ever possible before with other materials. Besides resisting most acids, B. F. Goodrich Koroseal stands just about everything else that ruins most materials; and it is *permanently* waterproof.

You can be sure of top performance and real money savings when you buy industrial products—made of Koroseal or rubber—from your B. F. Goodrich distributor. *The B. F. Goodrich Company, Department M-554, Akron 18, Ohio.*

Koroseal—T. M. Reg. U. S. Pat. Off.

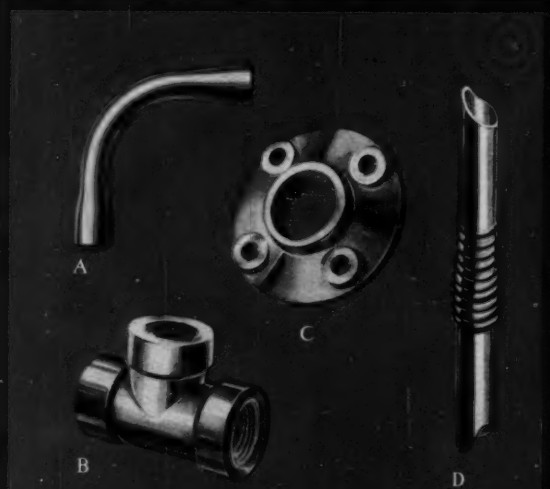
B.F.Goodrich
INDUSTRIAL PRODUCTS DIVISION

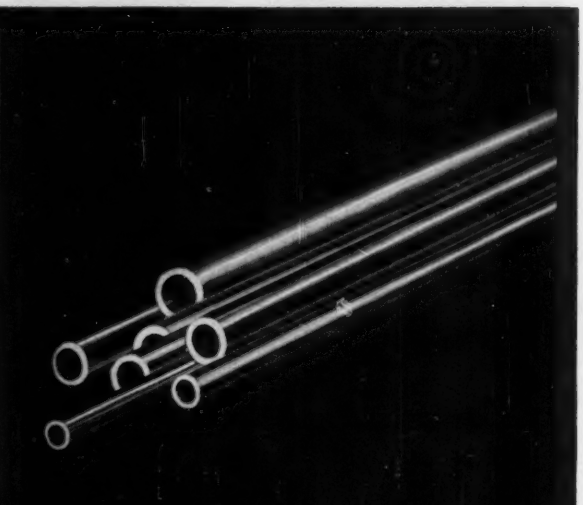
ONE MATERIAL...

EXCLUSIVE WITH BOLTARON TWO NEW CONCEPTS IN FITTINGS AND DESIGN!

SHRINK FITTINGS Specially designed PVC fittings that, when heated, shrink to form an air-tight, leak proof, permanent mechanical bond insuring a non-corrosive, free-flow piping system.

ROLL-THREAD DESIGN Specially engineered PVC pipe that, through the use of a roll thread, forms a mechanical bond better than conventional threading for larger sized pipe. Available in 3", 4", and 6" diameters. Quick and easy installation.





FITTINGS

Boltaron offers you the only complete line of PVC fittings in a full variety of sizes. The line includes ells, tees, plugs, caps, couplings, bushings, unions, flanges and expansion joints in standard pipe threads and, in most cases, the new shrink fitting and roll-thread design. All molded standard threaded fittings are produced by Stokes Molded Products.

All Boltaron fittings are made of Boltaron 6200 unplasticized PVC and are manufactured under rigid inspection standards. This assures you of uniformity of quality and maintenance-free, corrosion-free action in your PVC installations.

A. Shrink-fitting ell*
B. Threaded tee
C. Standard flange
D. Roll-thread pipe

* Patent applied for

PIPE

A complete line of PVC pipe from ¼" through 6" in Schedules 40 and 80. Only one-sixth the weight of steel, Boltaron 6200 pipe offers easy handling and quick installation.

Like other Boltaron 6200 PVC products, it has outstanding resistance to corrosive gases and liquids, treated and untreated waters, alcohols, alkalies and acids; it's a non-conductor, thus eliminating electrolysis problems. It's abrasion-resistant. Boltaron PVC pipe virtually eliminates maintenance.

TECHNICAL SERVICE: Our highly trained staff and that of our distributors and fabricators are located throughout the country to give you expert advice and service. They will advise you on the complete Boltaron 6200 unplasticized PVC line at no obligation.

TRAINING SCHOOL: The Plastic Fabricating Institute, located in Lawrence, Mass. and organized by H. N. Hartwell and Bolta Products is available to your personnel. Training is given to fabricators, distributors, piping contractors and industry in the application, fabrication, welding and forming of Boltaron 6200 unplasticized PVC.

ONE SOURCE...ONE QUALITY

Boltaron 6200

Registered Trademark, The General Tire & Rubber Co., Akron, Ohio

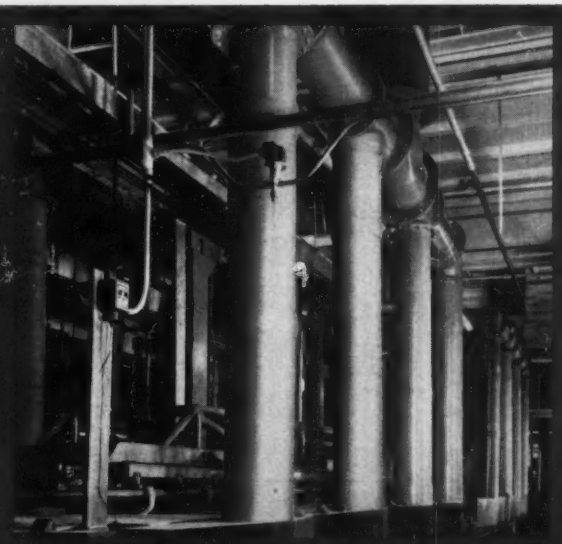
unplasticized PVC (type I)

THE ANSWER TO YOUR CORROSION PROBLEMS

VALVES

Boltaron PVC valves, engineered by Lunkenheimer. are the first all-molded unplasticized PVC valves designed and engineered by a valve manufacturer. Boltaron valves are available in ½" through 2" sizes. Component parts are made of Boltaron 6200 PVC. insuring complete corrosion-free service.

Boltaron 6200 is odorless, tasteless and resistant to industrial chemicals. Weighs only ½ as much as aluminum and can be molded to precise tolerances.



CUSTOM APPLICATIONS

Boltaron 6200 unplasticized PVC is available in corrosion-resistant pipe, rod, sheet and block form. Its handling versatility is unique. To fit your particular needs, Boltaron can be stamped, sheared, sawed, ground, turned and milled; it can be planed, drilled, embossed, drawn, molded, rolled, bent, heat or solvent welded. Whatever your needs — an exhaust system, acid piping or machined parts — Boltaron meets your specifications.

Our expert force of consulting engineers is at your service. Contact us — there's no obligation.

Some territories still available for fabricators and distributors

H. N. HARTWELL & SON, INC.

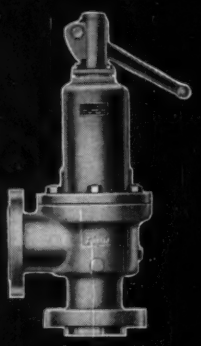
Industrial Plastics Division, Park Square Bldg., Box 102, Boston 16, Massachusetts

The only integrated source for Unplasticized PVC Materials

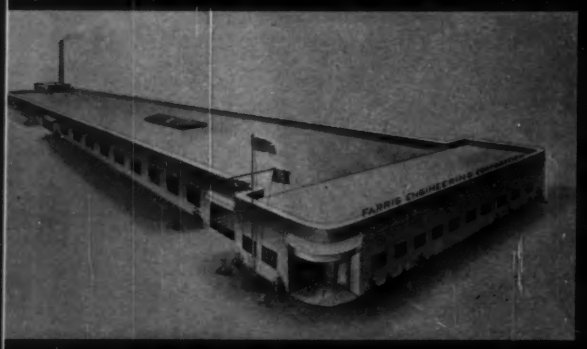
1943

1944

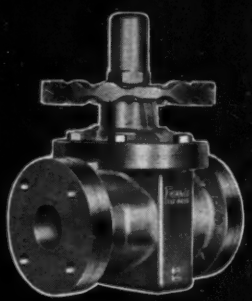
"Progress."



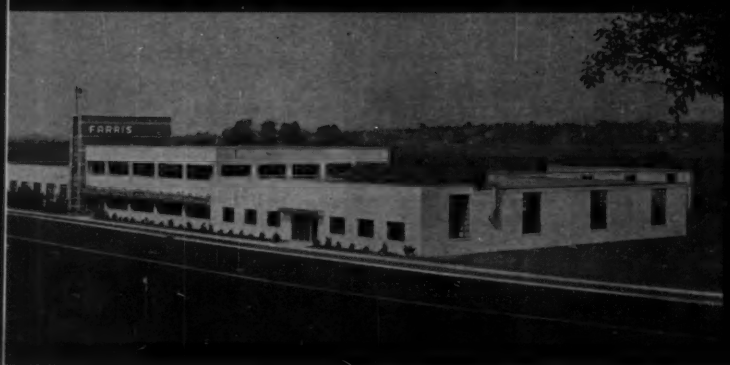
Safety-Relief Valves
Balanseal Bellows Valves
Farris Engineering Corp.



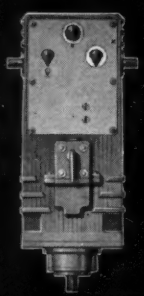
1945



Pinch Type Flexible
Diaphragm Disc and
SuperSeal Valves
Farris Flexible Valve Corp.



1951



Mechanical and
Hydraulic Governors
Farris Pickering
Governor Co., Inc.

U. S. Patents and Patents Pending

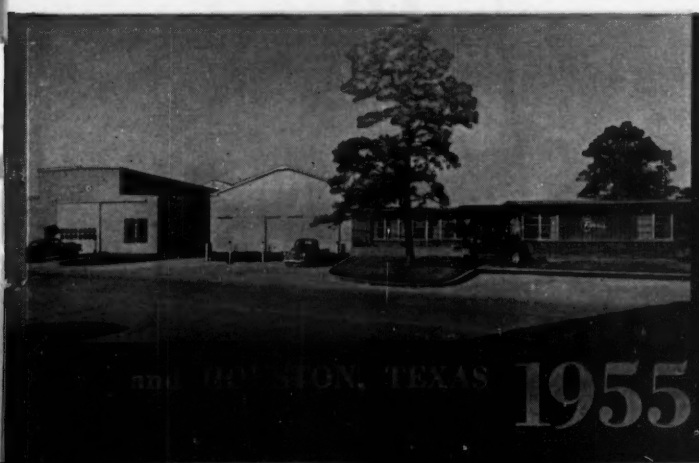
1955

... through honest purpose"

The larger and more experienced a manufacturer becomes, the more he appreciates that PROGRESS is not restricted to simply producing fine products at fair prices. Rather, it is the sum total of all the services he renders to his customers day by day and year by year. It is unceasing vigilance to assure customer satisfaction . . . it is constant concern for improvement—for *better* products at even *better* prices . . . it is strict adherence to a commercial code of honor, like Farris' policy of "Progress—Through Honest Purpose".

Evidence of this policy's success is seen in the rapid and constant growth of the Farris organization. And even as you read this, more facilities are being added . . . designed to provide even greater service for users of Farris Safety and Relief Valves (which have set the pace in design and performance and have been duplicated by other manufacturers), Farris "SuperSeal" Flex Valves and Farris Pickering Governors.

Behind our continuing growth and the world-wide recognition of Farris as a pacesetter in its field, is the fundamental belief that "honesty of purpose" when dealing with people is always to be trusted. Upon this belief we have grown . . . and, because they believe in the same things, our customers and friends have supported us. Here, beyond doubt, is proof that the right way to grow is THROUGH HONEST PURPOSE.



1955

PROGRESS THROUGH Farris HONEST PURPOSE

AFFILIATED COMPANIES

400 COMMERCIAL AVE., PALISADES PARK, N. J.

- Farris Engineering Corp.
- Farris Flexible Valve Corp.
- Farris Pickering Governor Co., Inc.
- Farris Hydrotorque Corp.
- Farris Hydroseal Corp.

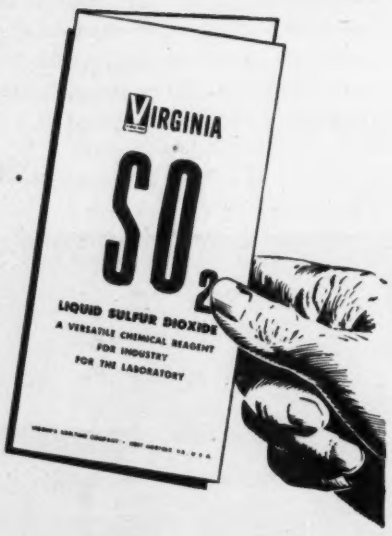
"VIRGINIA" SO_2

For many years, "Virginia" technical men have been tackling—*and solving*—some of the tough chemical problems for scores of diverse industries. We refer to the many successful and profitable applications of "Virginia" Liquid Sulfur Dioxide (SO_2) as a reducing, bleaching, neutralizing and preservative agent, *p*H control, antichlor and reaction medium.

These concerns have continued as "Virginia" customers for several good reasons. They like our readily available technical aid and the quality of our SO_2. And they find that the specialized facilities of America's top producer of this chemical mean quicker, more dependable deliveries.

Investigate the possibilities of improving your processes, upgrading your products—saving time and money—by using "Virginia" SO_2. Write today for folder on this versatile, low-cost chemical. Ask for one of our field men to call, if this personal service can be of any help to you.

Industrial Department, VIRGINIA SMELTING COMPANY, BOX 21, West Norfolk, Virginia.



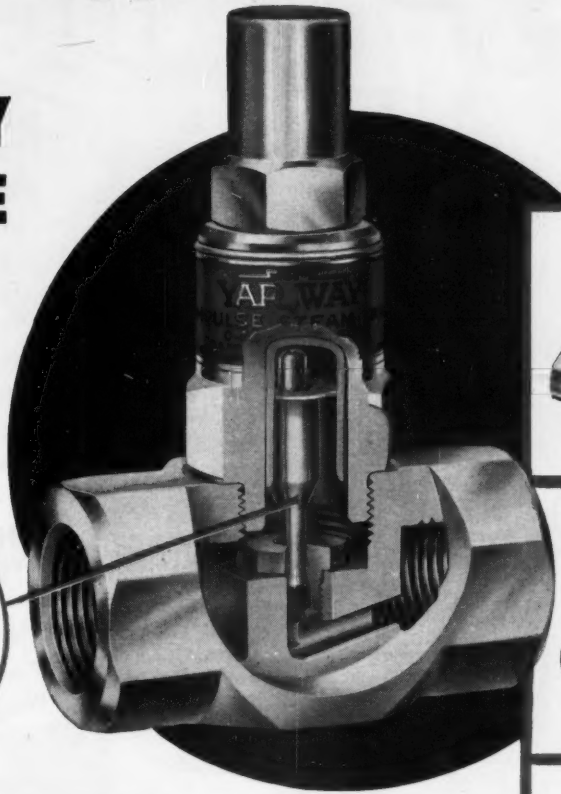
VIRGINIA *Chemicals*

Field Offices: NEW YORK • BOSTON • DETROIT • CHICAGO • ATLANTA • ASHEVILLE

Available in Canada and many other countries

the impulse that revolutionized steam trapping

YARWAY IMPULSE STEAM TRAP



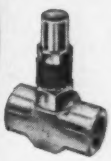
the only moving part

...a small stainless steel valve that literally floats on the condensate load. Gets equipment *hot in a hurry*—and *keeps it hot!*

SERIES 60 and 120

For all *normal* trap requirements, pressures to 400 and 600 psi.

½" No. 20-A

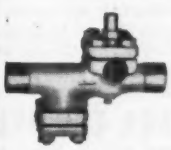


For *light loads* on tracer lines, steam mains, small presses, etc.

SERIES 40

For *heavy loads* requiring extra high capacity steam traps.

INTEGRAL-STRAINER HIGH PRESSURE TRAP



For *high pressures, high temperatures.* (Flanged or welding connections.)

Twenty years ago YARWAY applied a unique theory of thermodynamics to steam traps—and gave industry the amazing YARWAY Impulse Steam Trap.

Today — over a million YARWAY Impulse Steam Traps later — advantages like the following continue to convert new users, and convince old users to standardize on the YARWAY Impulse:

- **QUICK HEAT-UP AND EVEN TEMPERATURES OF EQUIPMENT**
- **GOOD FOR ALL PRESSURES WITHOUT CHANGE OF VALVE OR SEAT**
- **SMALL SIZE—LIGHT WEIGHT**
- **ONLY ONE MOVING PART**
- **STAINLESS STEEL—minimum maintenance**
- **WON'T FREEZE UP**
- **A COMPLETE LINE of sizes and types for every requirement**
- **IMMEDIATELY AVAILABLE from 270 local Industrial Distributors**

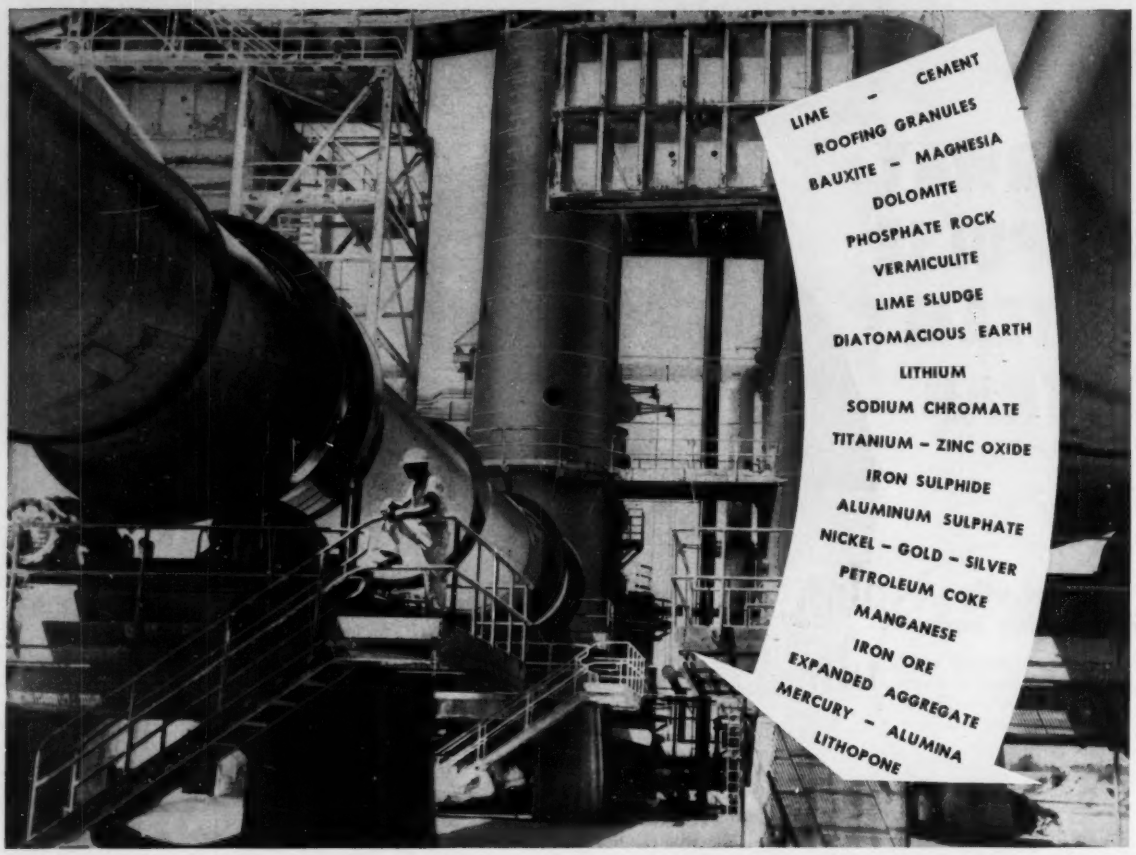
For free Trap Selector, or 24 page Bulletin, write

YARNALL-WARING COMPANY
137 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY IMPULSE® STEAM TRAP

OVER 1,000,000 YARWAY IMPULSE STEAM TRAPS USED

Traylor's half century of engineering leadership is at your command for more profitable production of many types of products such as:



FOR PRODUCTION ECONOMIES THAT SHOW UP IN PROFITS

Today, throughout the world, leaders in the process industries rely on Traylor Rotary Kilns to insure uniformly high product quality and maximum production efficiency.

With Traylor Rotary Kilns producing profits throughout the processing industry, chances are we have in the past "Traylor-Made" a Rotary Kiln very similar to the one you need for more efficient and profitable thermo-processing of your particular product.

Let Traylor Engineers show you how Traylor Rotary Kilns can achieve production economies that will show up in your profits. Write for Traylor Bulletin 1115 outlining the features of Traylor Rotary Kilns, Coolers and Dryers.

Traylor
ROTARY KILNS

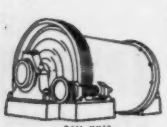
TRAYLOR ENGINEERING & MFG., CO.
840 MILL ST., ALLENTOWN, PA.

SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.

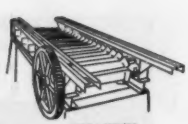
PRIMARY GYRATORY CRUSHERS

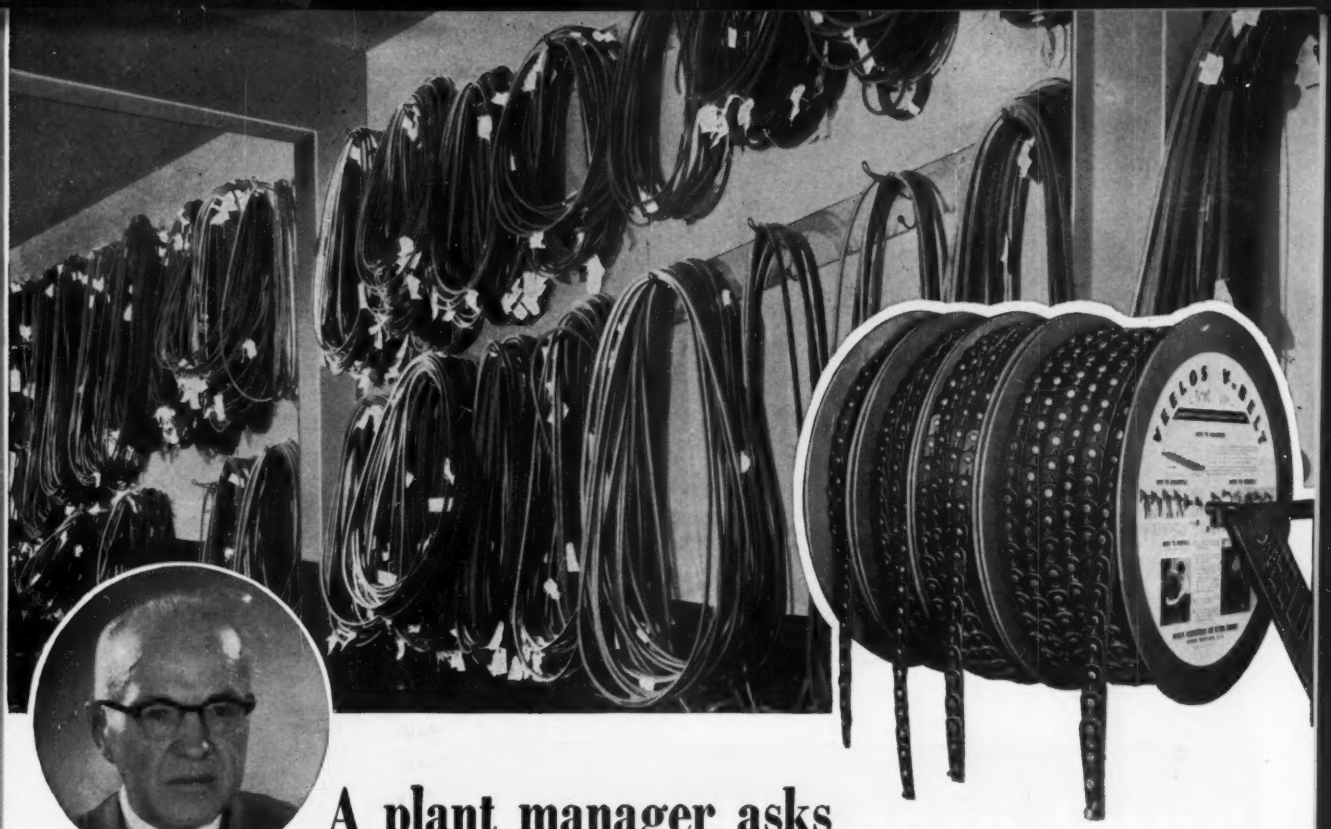
ROTARY KILNS

SECONDARY GYRATORY CRUSHERS


BALL MILLS

JAW CRUSHERS


APRON FEEDERS



A plant manager asks 3 leading questions about V-belts

1 "I stock 85 different sized sets of belts—how can Veelos help me?"

With *four* 100′ reels of Veelos (O, A, B, C widths) you can replace as many as 316 different sizes of endless belts —and store your Veelos in *inches of space!* Veelos cuts your inventory to a minimum. No obsolescence or deterioration, no worries about specific sizes. With Veelos, your storage and inventory problems are licked!

2 "How does Veelos cut installation and down-time?"

Veelos is an *adjustable belt.* With Veelos, there's no tearing down outboard bearings, no resetting, tilting or moving motors to make belt replacement or repairs! And you don't have to replace a complete matched set because of one loose belt—Veelos belts adjust to any length, can be altered by adding or removing links!

3 "How do I eliminate costly belt vibration?"

Install Veelos in place of ordinary belts! Veelos belts are absolutely uniform; every stud and link is identical; every foot of the reel is identical and uniform; they're perfectly balanced. Your Veelos salesman can easily prove to you with a Veelos Vibration Analyzer (tested against any V-belt you might now be using) that Veelos *cuts vibration up to 90%!*

VEELOS
THE BALANCED
LINK V-BELT

Veelos is known as Veelink outside U.S.A.

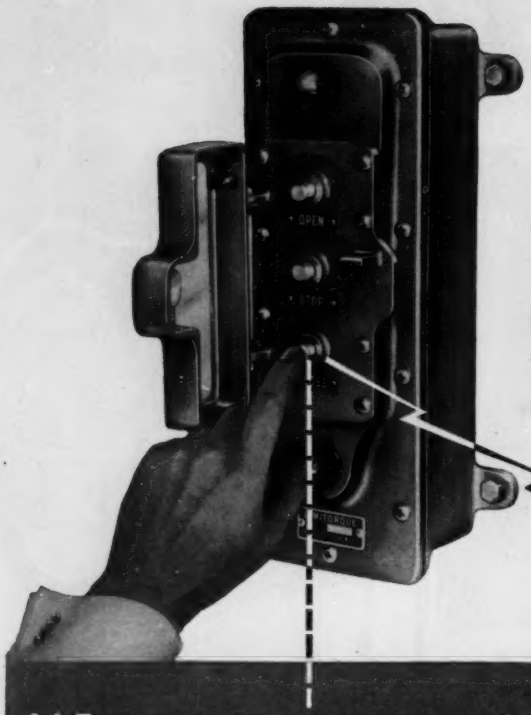
Get your free Veelos Data Book; many pages of important information on belt drives. Write to:

MANHEIM
Manufacturing & Belting Company
110 Stiegel St., Manheim, Pa.

"Industrial Belt Specialists Since 1911"

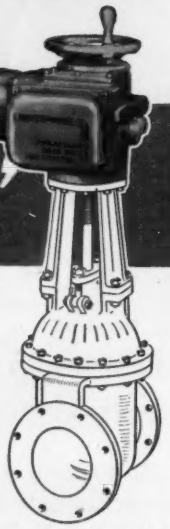
© M.M.&B. Co. 1956

Adjustable to any length • Adaptable to any drive • Balanced power • Constant power • Vibrationless power



truly *Automatic* VALVE OPERATION *with* Limitorque®

"just press the button"



The above is a Type SMA-000 LimiTorque for operating smaller valves. There's a type and size of LimiTorque for every valve operating need.

Think of the time, labor and money that can be saved by opening and closing valves in remote, inaccessible or distant locations with LimiTorque . . . automatically, from a centrally located control panel. LimiTorque not only operates valves at the speed required, but it "limits the torque" applied to the valve operating parts and thus prevents damage to stems, seats, discs or gates . . . and too, the handwheel "cannot rotate" when the valve is being motor-operated. LimiTorque may be actuated by any available power source; such as electricity, gas, steam, water, oil or air—and is readily adapted for Microwave Control. Thousands of these units are being used in Power Plants, Oil Refineries and Pipe Lines, Water and Sewage Plants, Chemical Plants, Pulp and Paper Mills, and on Shipboard.

Send for Catalog L-550, and be convinced.

PHILADELPHIA GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
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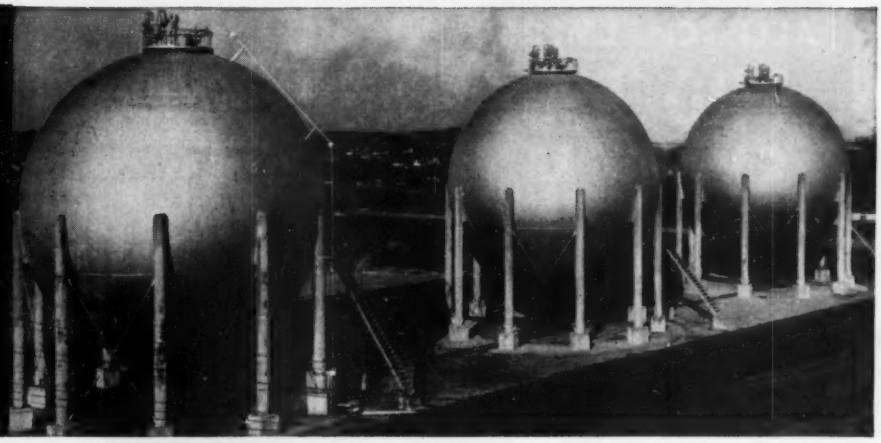
LimiTorque Corporation—Philadelphia

Industrial Gears & Speed Reducers • LimiTorque Valve Controls

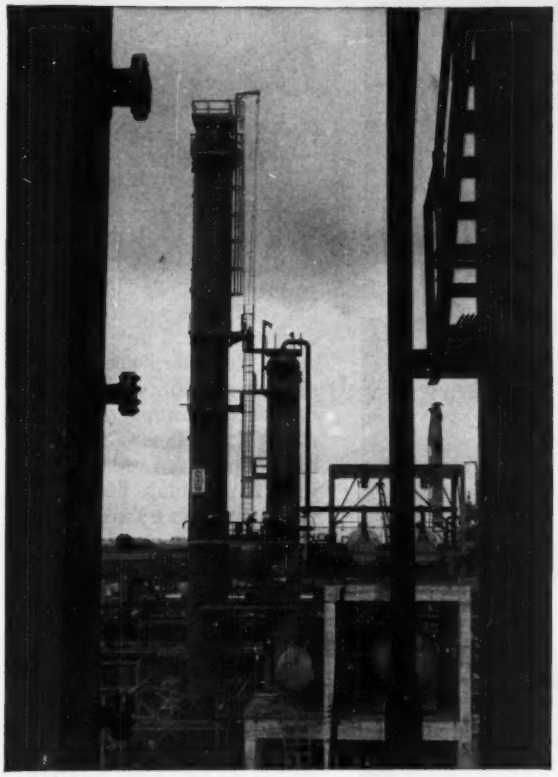
ESTABLISHED 1892

GRAVER

...Serving the petroleum industry



Graverspheres are your answer to high-pressure storage needs. Constructed to Graver's exacting standards, these spheres are available in capacities to 20,000 bbl.



Fractionating towers...intricate process vessels—all reveal the inherent fabricating skill of Graver craftsmen. Graver works in carbon steel, stainless, nickel-clad, Hastelloy and aluminum.

at Refineries...
Petrochemical plants

GRAVER®

Craftsmanship is in demand

GRAVER TANK & MFG. CO., INC.
East Chicago, Indiana

CHICAGO • NEW YORK • PHILADELPHIA • EDGE MOOR, DELAWARE
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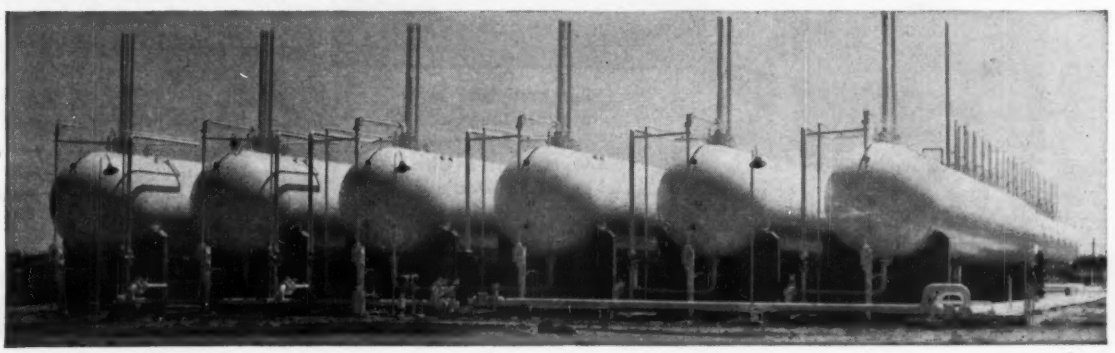
TULSA • SAND SPRINGS, OKLAHOMA • HOUSTON • ODESSA, TEXAS
CASPER, WYOMING • LOS ANGELES • FONTANA, CALIFORNIA • SAN FRANCISCO

Graver-built butane and propane storage tanks are popular throughout the country. They meet and exceed all the standards required for difficult and specialized purposes.

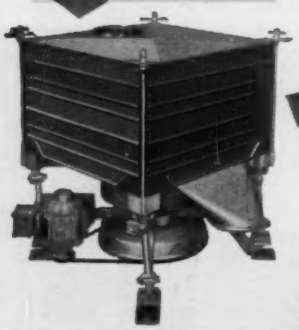


ALLIS-CHALMERS

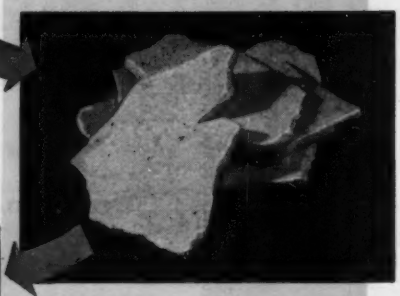
PROCESS SYSTEM Converts Fine Particles Into Granular Product To Meet Consumer Demand

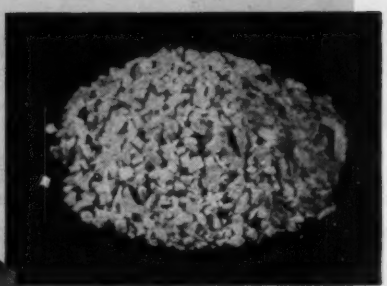
Compacting Mill

Roller Mill



Circle Sifter





1 Recovery operation starts with unacceptable minus 30 mesh chemical salt — fines created in original process.

2 An Allis-Chalmers heavy duty compacting mill is the principal component in the recovery system. The flakes or slabs illustrated are the result of mechanical densification in the compacting mill. An Allis-Chalmers two-pair high corrugated roller mill is used to granulate flakes. Final separation is made in the *Circle* sifter — an Allis-Chalmers gyratory screen. An 80% to 90% recovery of salable product is effected.

3 The resulting granules (100% minus 3 mesh and 100% on 10 mesh) equal or surpass natural product in every respect. Reconstituted product differs little from parent product in abrasion tests. Other tests have proved the compacted granule superior in controlled solubility. Granulated product is more uniform in particle size, flows more freely and has better "eye-appeal."

A-4743

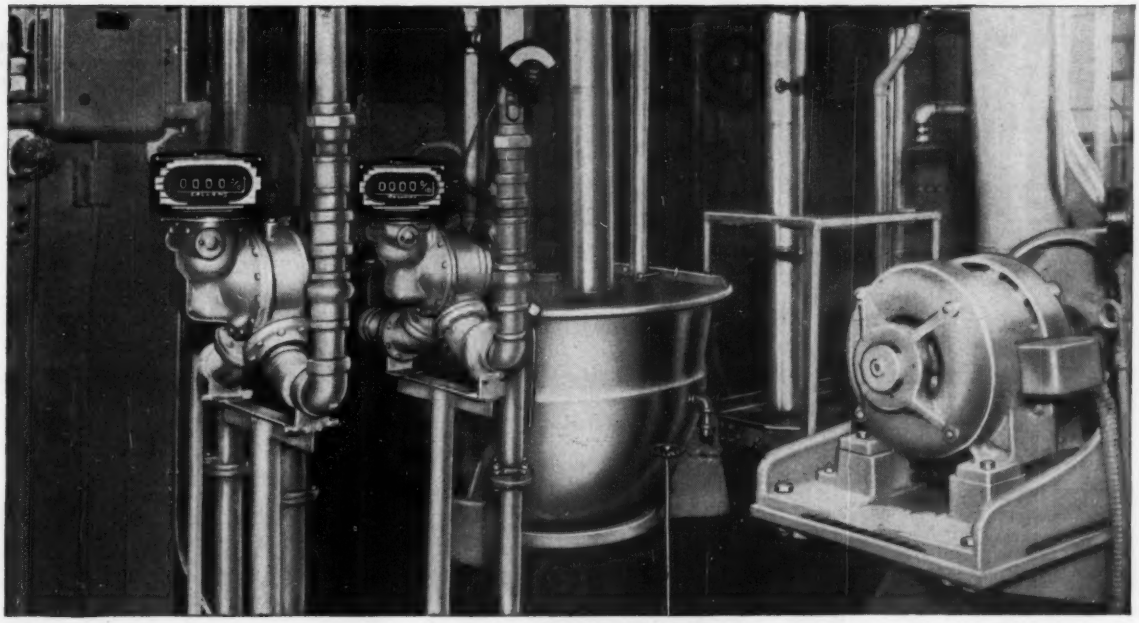
For complete information, see your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 25C6177J.

Circle is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Rockwell *Stainless Steel* Meters

MEASURE CORROSIVE LIQUIDS—FAST!

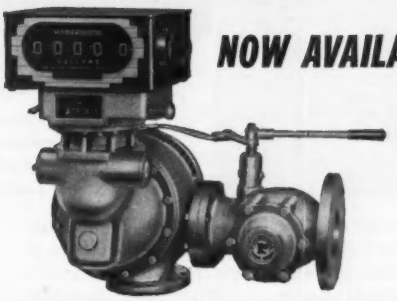


For Foods, Pharmaceuticals, Chemicals and Liquors

These Rockwell meters are constructed *inside and out* of stainless steel. With them you can get positive liquid accounting over a multitude of fluids that cannot be measured by ordinary meters. You can use them *with profit* to cut liquid handling and processing costs, to guard the quality of your end products, to stop losses. And your accountants will welcome these meters for cost control and tax analysis purposes. Get full facts now. Use the handy coupon—or write for bulletins.

Use For All These Purposes

- Liquid Delivery Control
- Formula Control—Cost Control
- Product Quality Control
- Departmental & Inventory Control



NOW AVAILABLE

Automatic Pre-Set Meter Shut-off *without shock.* All stainless construction. Just pre-set the quantity to be measured, then meter and automatic valve take over to shut-off flow in three (3) smooth successive stages without harmful hydraulic shock.

CLIP COUPON MAIL TODAY

ROCKWELL MANUFACTURING COMPANY 104-B
Pittsburgh 8, Pennsylvania

Gentlemen:

I am interested in measuring _____ (Name of Liquid)

Pipe Size _____"

Working Pressure _____ psi Temperature _____ °F max.

Max. Flow Rate _____ gpm Min. Flow Rate _____ gpm

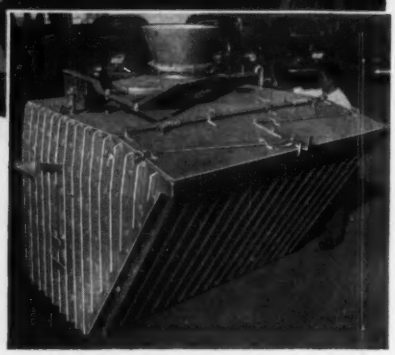
YOUR NAME _____

COMPANY _____

STREET _____

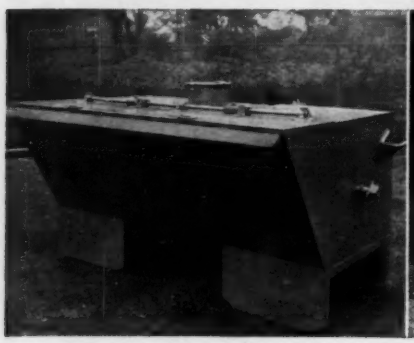
CITY _____ ZONE _____ STATE _____

These save

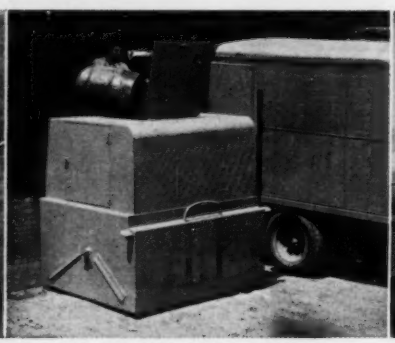


Dempster-Dumpster serving a 6 cu. yd. container with cooling fins for handling a high temperature product.

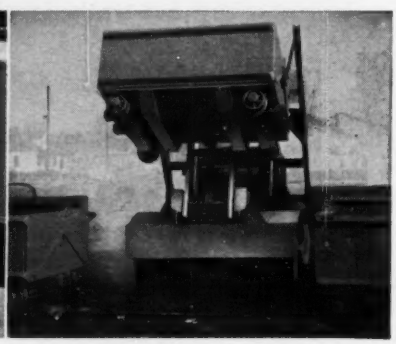
Here are a few of the hundreds of Detachable Containers we have built to solve handling problems of every description. A few others not shown include those with compartments . . . with insert containers . . . fully-insulated . . . lined with lead . . . lined with fire brick . . . with windows and doors . . . with casters . . . flat bottoms and open at one end . . . with teeth . . . with shelves for tools and supplies—and we could describe hundreds more, all served by one Dempster-Dumpster and only one man, the driver.



This 3 cu. yd. Container has skids for fork lift truck transfer.



10 cu. yd. Container widely used for refuse and combustible wastes.



Flanged wheel equipped containers for remote loading.

5176

DEMPSTER

4 manufacturers to $82,000.00 annually handling waste materials!

These four industrial plants expect to save, in labor costs alone, during the first five years service of the Dempster-Dumpster System—

A PLASTICS PLANT: $26,958.00 savings on an investment of $9,523.50 in Dempster-Dumpster equipment. Savings alone pay for equipment in two years.

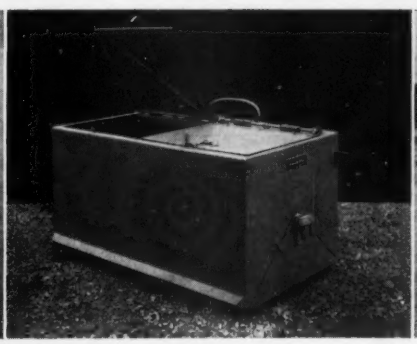
A CHEMICAL PLANT: $204,076.75 savings on an investment of $40,968.00 in this equipment . . . savings pay for equipment in one year.

AN AUTOMOTIVE PLANT: $135,000.00 savings on an investment of $19,272.00 . . . savings pay for equipment in 9 months.

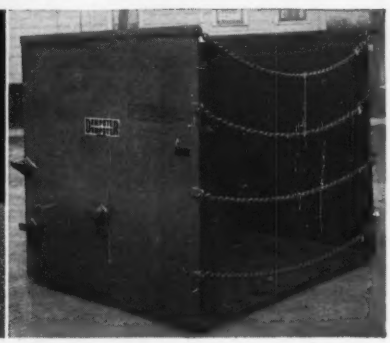
A PAPER AND PULP MILL: $43,104.00 savings on an investment of $10,750.00 . . . savings pay for equipment in 1¼ years.

Those are typical examples. Visualize a Dempster-Dumpster, operated by only one man, the driver, serving scores of big steel containers, one after another, in your plant. Containers of many designs and types, handling waste or salvable materials, raw or finished products, fluids including acids, combustibles, dusty materials—anything that can be handled in up to 21 cu. yd. detachable Dempster-Dumpster Containers . . . payloads up to 19 tons. Savings are tremendous! Take advantage of our free engineering service, which determines by fact-finding survey the cost cutting possibilities of this system in your plant. Dempster Brothers, Inc.

600 Gal. stainclad tank with brine cooling channels.



A Container available up to 10 cu. yds. with or without lids for many uses.



A 9 cu. yd. container for handling packaged products.

BROTHERS 226 Dempster Bldg., Knoxville 17, Tenn.

KAMLOK
COUPLING ASSEMBLIES

The Fastest Surest Coupling Known!

KAMLOKS positive seal all along the line assures *greater safety* in handling any type of liquid. A perfectly tight no leak connection is made in seconds by sliding coupler over adaptor, then pressing cam levers. No threads to engage, no twisting friction against gaskets, no tools required. KAMLOKS provide long years of economical trouble free service.

Available in any combination to meet coupling requirements in sizes from ¾" to 4" inclusive. Sizes ¾" to 3" precision machined of special hard wear resistant bronze. 4" size of hi-tensil OPALUMIN, (OPW hi-tensil aluminum alloy requiring no additional heat treating). 4" in bronze on special order.

Parts A, E, F, are interchangeable with parts B, C, D, G, H, in the same size.

BRONZE • ALUMINUM • MONEL

OPW CORPORATION

2725 COLERAIN AVE. • CINCINNATI 25, OHIO

FREE BULLETIN—*F 10 tells the Complete Kamlok Story.*

OPW CORPORATION FOR HANDLING HAZARDOUS LIQUIDS — OPW — VALVES • FITTINGS • ASSEMBLIES — CINCINNATI 25, OHIO

ADVERTISEMENT— *This entire page is a paid advertisement* *Prepared by U. S. Industrial Chemicals Co.*

U.S.I. CHEMICAL NEWS

Jan.-Feb. ★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1956

Phosphoric Acid Plant Planned by U.S.I.

Plans to build a new plant at Tuscola, Illinois to produce wet-process phosphoric acid have been announced by U.S.I.

Annual production capacity will be 60,000 tons of 75% phosphoric acid, produced from sulfuric acid and phosphate rock by a process developed by the S. A. Metallurgique de Prayon, a Belgian company. Singmaster and Breyer will engineer and construct the plant, which is expected to start operating at the end of 1956.

U.S.I. already produces sulfuric acid, ammonia and nitrogen solutions at Tuscola. The addition of phosphoric acid to this range of fertilizer raw materials will substantially expand the scope of U.S.I.'s service to fertilizer manufacturers in the mid-west farm belt.

U.S.I. Changes to 55 Gallon Drum Filling

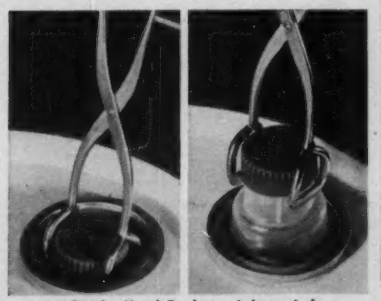
As of January 1 U.S.I. is using a new drum for shipment of SOLOX® Proprietary Solvent Alcohol and a number of other solvents. This new standard drum is gradually being adopted by most suppliers, and will eventually become standard for all U.S.I. products. Net capacity is 55 gallons — the older one contained 54.

Because of the stocks of filled drums maintained in U.S.I. warehouses for customer convenience, 54 gallon drums will be shipped until inventory is depleted.

New Folder Aids U.S.I. Alcohol Users

Five-gallon drums of U.S.I. ethyl alcohol, USP come equipped with the FlexSpout* closure, a leakproof, tamperproof polyethylene spout which offers alcohol users greater convenience in handling and pouring. Five-gallon drums of SOLOX®, U.S.I.'s proprietary denatured alcohol solvent, and many other U.S.I. chemicals and solvents are also equipped with this closure.

An illustrated folder now available from U.S.I. describes the closure and shows how it can best be opened. Although mentioned only briefly in the folder, some users have discovered that a pair of ordinary kitchen tongs, the kind normally used for handling baby bottles, also makes an excellent opener for the FlexSpout. The technique is illustrated below.



*®Rieke Metal Products, Auburn, Ind.

WORLD'S FIRST COMMERCIAL ISOSEBACIC ACID PLANT PLANNED BY U.S.I. FOR 1957

New Intermediate Shows Promise In Plastics Industry For Plasticizing And Other Functions

The first commercial plant in the world for the production of isomers of sebacic acid, known as "U.S.I. Isosebacic" acid, will be built at Tuscola, Illinois. Initial production capacity of the plant will be 10 million pounds per year and completion of the plant is scheduled for early in 1957. Catalytic Construction Company of Philadelphia, will be engineers and contractors for the project.

"U.S.I. Isosebacic" acid is a mixture of isomers of sebacic acid in approximately the following proportions:

2-ethylsuberic acid	72-80%
2,5-diethyladipic acid	12-18%
Sebacic acid	6-10%

This new product is the result of more than three years of research which began under the auspices of a National Distillers' fellowship at the University of Cincinnati and progressed through the company's research laboratory. For the last two years, "U.S.I. Isosebacic" acid has been in pilot plant production, first at U.S.I.'s former Fairfield plant and more recently in the company's new pilot plant facilities at the Cincinnati Research Laboratory.

The Cincinnati pilot plant will continue to operate to supply samples and to develop further process refinements until the Tuscola plant comes on stream.

Over 400 research laboratories already have received samples of "U.S.I. Isosebacic" acid for evaluation. The product shows considerable promise as a raw material for vinyl resin plasticizers with excellent low-volatility, non-migration, and low-temperature characteristics.

Other promising applications include: the production of polyamide (nylon type) mold-

MORE

"U.S.I. Isosebacic" acid goes into plasticizers for vinyl resins, which are used to make items such as the plastic curtains shown here.

Minimum Daily Methionine Requirement Reaffirmed

Recent research has reaffirmed that for healthy adults, a minimum daily intake of 1.1 gm. of methionine is required to maintain positive nitrogen balance in humans.

As with other amino acids, the exact amount varies slightly from one individual to another, but appears to be independent of body weight, surface area or creatinine output.

D-Methionine, in contrast to the behavior in man of the D-isomers of all other essential amino acids, proved during tests to be equally as effective as DL-methionine in the maintenance of nitrogen balance. From this it follows that the L-isomer has no greater metabolic activity than the Racemic mixture (DL-methionine).

The amount of 1.1 gm. of either the L- or the DL-isomer was tentatively established as the minimum daily requirement of man, and 2.2 gm. was recommended as a safe daily intake.

Sodium Dispersion Package Units Can Now Be Purchased

Two package sodium dispersion units have been placed on the market by the Cowles Dissolver Company, Cayuga, N. Y. Both models, the 1000-2000 ml laboratory unit and the 3-7 gallon pilot unit, have been designed jointly by Cowles and the U.S.I. Research Department.

Although all the necessary parts, from motor drive to thermometer are contained in these package units, heart of each model is the Cowles "Dissolver", the particular impellor design that has been found extremely efficient in dispersing sodium in an inert organic medium.

The laboratory unit consists of 2 liter resin flask, metal thermometer, copper coil condenser, dropping funnel and 3" Cowles "Dissolver". Heat is furnished by Glas-Col electric heating mantle. The "Dissolver" is attached to ½" shaft connected by flexible

MORE

Jan.-Feb. ★ **U.S.I. CHEMICAL NEWS** ★ 1956

CONTINUED **Isosebacic**

ing and extrusion plastics and adhesives; alkyd resin manufacture, to impart flexibility and water resistance to the surface coating film; the synthesis of ester lubricants of the type used in jet propelled aircraft; the production of polyester resins used in the manufacture of glass reinforced plastics; the synthesis of polyurethane resins for foamed plastics, synthetic rubber and protective coatings.

This new chemical is produced by a novel process for which the principal raw materials are butadiene, a petrochemical, and sodium, of which U.S.I. is an important producer. Tuscola was chosen as the location for the new plant because of the availability of raw materials at this site – hydrocarbons from National Petro-Chemicals Corporation as well as sulfuric acid and other raw materials from the adjacent U.S.I. installation.

Electrical Grades, U.S.I. Polyethylene, Introduced

The PETROTHENE® 300 series of electrical grade polyethylene resins has just been introduced to meet the variety of electrical specifications for infantry field wire, line wire covering, TV lead-in wire, high frequency and high voltage insulation and, in general, all wire and cable insulating and jacketing applications.

Melt indexes for the uncompounded grades are as follows:

PETROTHENE 300 – 0.3
PETROTHENE 301 – 1.0
PETROTHENE 302 – 2.8

Each of these types is also supplied compounded with antioxidant, with antioxidant and carbon black, with non-discoloring antioxidant, and with non-discoloring antioxidant and carbon black, as well as with other colors.

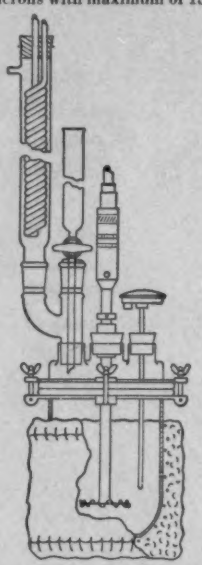
PETROTHENE 300 and 301, uncompounded materials, can also be used for other applications requiring very high molecular weight material, and requiring high toughness and resistance to environmental stress cracking. Blow molded bottles and closures that are exposed to solvent type detergents, cosmetics, etc., are possible applications.

CONTINUED **Sodium**

coupling to high speed motor.

The laboratory procedure for preparing dispersed sodium is described in the U.S.I. brochure "Sodium Dispersions". Sodium, dispersing medium and dispersing aid are charged into flask and heated to 110-120°C and whole system kept under dry nitrogen atmosphere. Baffling is not required. Once temperature is above the melting point of sodium, the motor is started and allowed to reach 4000-5000 rpm. range. Particle size of 2-20 microns (checked with a microscope with a calibrated eyepiece) is obtained in 6-8 minutes.

No loss in dispersing efficiency has been observed in scaling up from laboratory to pilot plant. For example, preparation of 3-4 gallons of sodium dispersion in 5-gallon vessel with 6" "Dissolver" may be accomplished in 10-20 minutes. Sodium particle size averages 6-8 microns with maximum of 15 microns.



SODIUM DISPERSION PACKAGE UNIT (LABORATORY MODEL)

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

Temporary window closures of polyethylene film are being used on construction jobs, permitting work to continue in bad weather. Film has blocked winds up to 65 miles per hour, holds in heat, admits daylight. **No. 1130**

Film badges for detecting radiation are now available to insure personnel protection in x-ray and radioisotope labs, industrial plants doing gamma radiography, and doctor's and dentist's offices. Badges read from .05 to 300 r. **No. 1131**

New refined liquid lanolin has high solubility, stability, versatility in drugs and cosmetics. Amber-colored oil is result of 11-step refining process. Properties same as lanolin except non-tacky, lower melting point. **No. 1132**

Polyethylene gas scrubber, recently developed, resists chemical attack at temperatures up to 170°F. Will be used with hydrofluoric acid and fluorides. Designed for gas flow of 2500 cu. ft./min. at 1½ psi. **No. 1133**

New volatile solvent concentrate acts as strong synergist with low-cost solvents, boosting dissolving power and drying performance. Does not burn, imparts fire extinguishing properties, has relatively low toxicity. **No. 1134**

To hold temperatures close to Absolute Zero, new type refrigerator has been developed based on cyclic principle of magnetic cooling. No moving parts or flowing fluids. First apparatus to both produce and maintain extreme cold over long periods. **No. 1135**

Colored aluminum for architectural use now made possible by treating anodized aluminum with new lightfast organic dyes. The colored anodic films are part of metal surface itself—will not peel, chip or scale. **No. 1136**

Succinic acid, organic polybasic acid, now available commercially for formulation of plasticizers, polyesters, alkyd resins, paints, drugs, cosmetics, chemical intermediates. **No. 1137**

Paper made wholly from nylon fiber, produced commercially for first time, is many times stronger than conventional types. Resists action of chemicals, mold, bacteria, light. Absorbs little moisture. **No. 1138**

Aqueous calcium stearate dispersion has been developed to improve coating formulations for machine coated papers. Product improves gloss, effective plasticizing, water repellency; provides lubrication, non-dusting, good flow. **No. 1139**

PRODUCTS OF U.S.I.

AGRICULTURAL CHEMICALS:

Ammonia, Anhydrous—Commercial and refrigeration grades in tank cars or tank wagons.

Nitrogen Fertilizer Solutions—Aqueous solutions of ammonium nitrate and ammonia in all standard analyses.

Sulfuric Acid—All strengths from 60° Baumé to 40% Oleum. Also Electrolyte grade meeting Federal Specifications. Tank cars or tank wagons.

OTHER PRODUCTS:

Alcohols: Ethyl (pure and all denatured formulas), Normal Butyl, Amyl, Fusel Oil; Proprietary Denatured Alcohol Solvents SOLOX®, FILMEX®, ANSOL® M, ANSOL® PR.

PETROTHENE® Polyethylene Resins.

Inorganic Chemicals: Caustic Soda, Chlorine, Metallic Sodium, Sodium Peroxide.

Esters, Ethers and Ketones: Normal Butyl Acetate, Dibutyl Phthalate, Diethyl Carbonate, Diethyl Oxalate, Ethyl Acetate, Ethyl Ether, Acetone.

Intermediates and Fine Chemicals: Acetoacetarylides, Ethyl Acetoacetate, Ethyl Benzoylacetate, Ethyl Chloroformate, Ethylene, Ethyl Sodium Oxalacetate, Sodium Ethylate solution, Urethan USP (Ethyl) Carbamate).

Animal Feed Products: Calcium Pantothenate, Choline Chloride Products, Curbay B-G® 80, Special Liquid Curbay®, DL-Methionine, Niacin USP, Riboflavin Concentrates, Vitamin B_{12} and Antibiotic Feed Supplements, Vacatone® 40, Vitamin A, D_3 and K_3 products.

Pharmaceutical Products: DL-Methionine, N-Acetyl-DL-Methionine, Riboflavin USP, Urethan USP, Intermediates.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation
99 Park Avenue, New York 16, N. Y.

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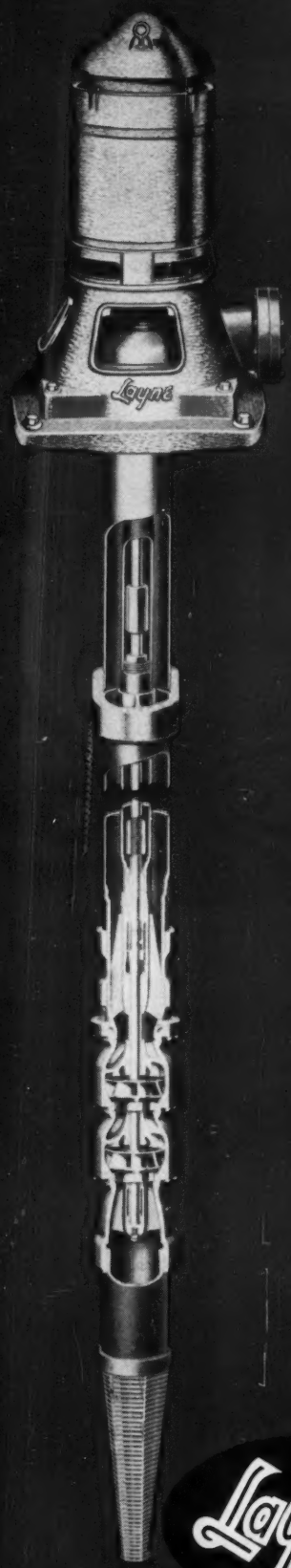


There are Many Reasons for World Leadership of...

Layne

VERTICAL TURBINE PUMPS

Tested and proved in thousands of installations of all types, the world-wide leadership of Layne pumps has led the field for one overall reason—PERFORMANCE . . . under all kinds of operating conditions.

That envied, but never duplicated, performance record has been made for many reasons. These are a few:

1. Complete and undivided manufacturing responsibility: Every part of every Layne pump is manufactured in the Layne factory to Layne high standards.
2. Concentration on one make: A lifetime of experience is behind every Layne pump . . . and that accumulated "know how" is focused on one pump alone.
3. Proven design: The basic design of a Layne pump has been job tested under every conceivable operating condition. And that design is converted into a finished unit through a series of highly specialized and quality-controlled factory operations.

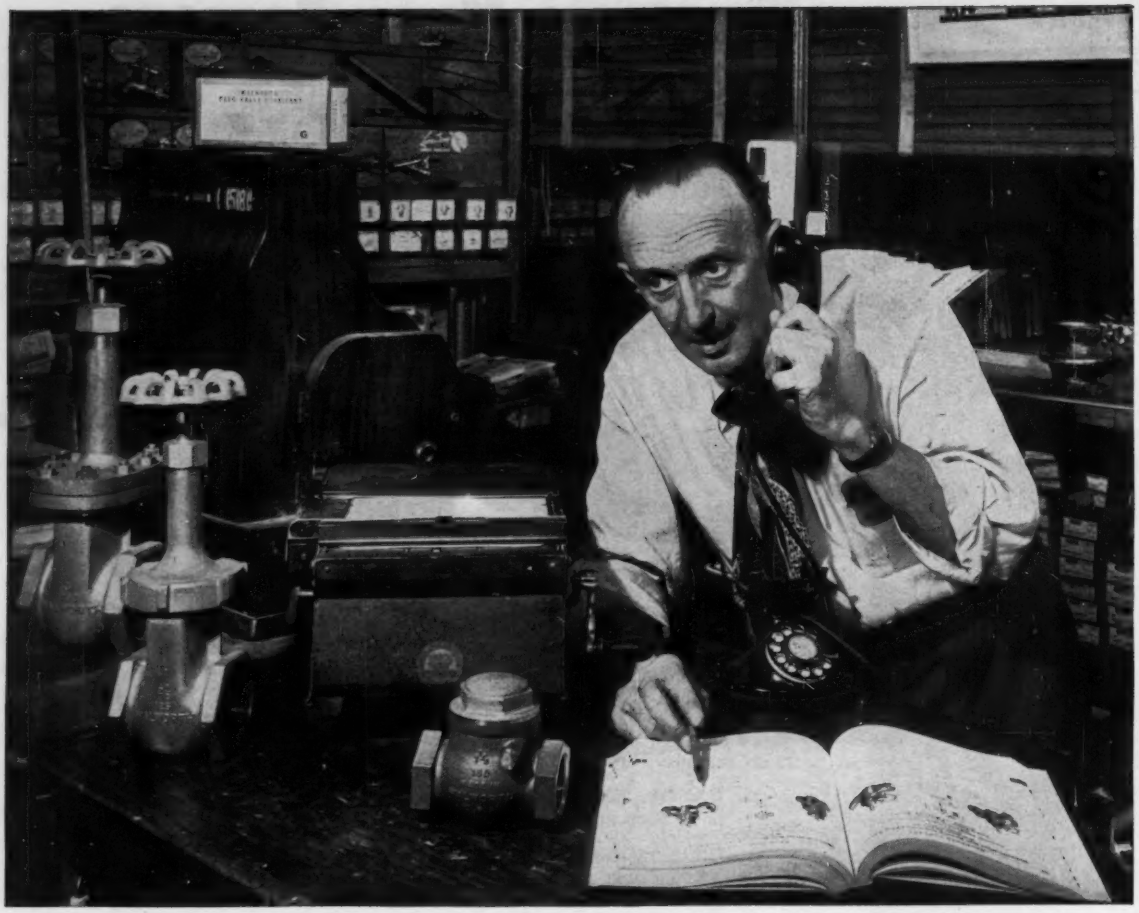
To know all the reasons why Layne pumps are preferred by Industry—Municipalities—and Agriculture, write for bulletin number 100.

LAYNE
& BOWLER, INC.
MEMPHIS
General Offices and Factory

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

Layne

Water Wells · Vertical Turbine Pumps · Water Treatment



*Fictitious name used to typify over 400 Walworth Distributors

Here's why it pays to do business with distributors like Mr. Hansen*

Andy Hansen is typical of Walworth Distributors throughout the nation. He has been a distributor of Walworth Valves and Fittings for years. Like Andy, the Walworth Distributor in your area provides these services and savings:

He reduces your inventory costs. He's aware of the valve and fitting needs peculiar to his area. He stocks the products that will best serve your needs. Deliveries are always prompt and economical – emergency orders can generally be delivered within hours.

He offers you application and engineering assistance. His technical experience can be invaluable in solving your particular problems. He has 50,000 Walworth products at his disposal. You can be sure that the items he recommends are exactly right for the job.

He is a double guarantee. His business depends upon providing you with the very finest products and unsurpassed service. Every valve and fitting is backed by his own reputation and that of Walworth – a complete line manufacturer.

There's a Walworth Distributor near you ready to help. Call on him today.

WALWORTH

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

Walworth Company of Canada, Ltd., Toronto

Now Ready to Serve You from the Heart of the Southeast with Quality ANHYDROUS AMMONIA

Our modern plant at Ketona, Ala., is now on stream producing quality anhydrous ammonia in commercial and refrigeration grades. Additional facilities to meet your requirements for nitrogen solutions of all popular formulations will also soon be completed.

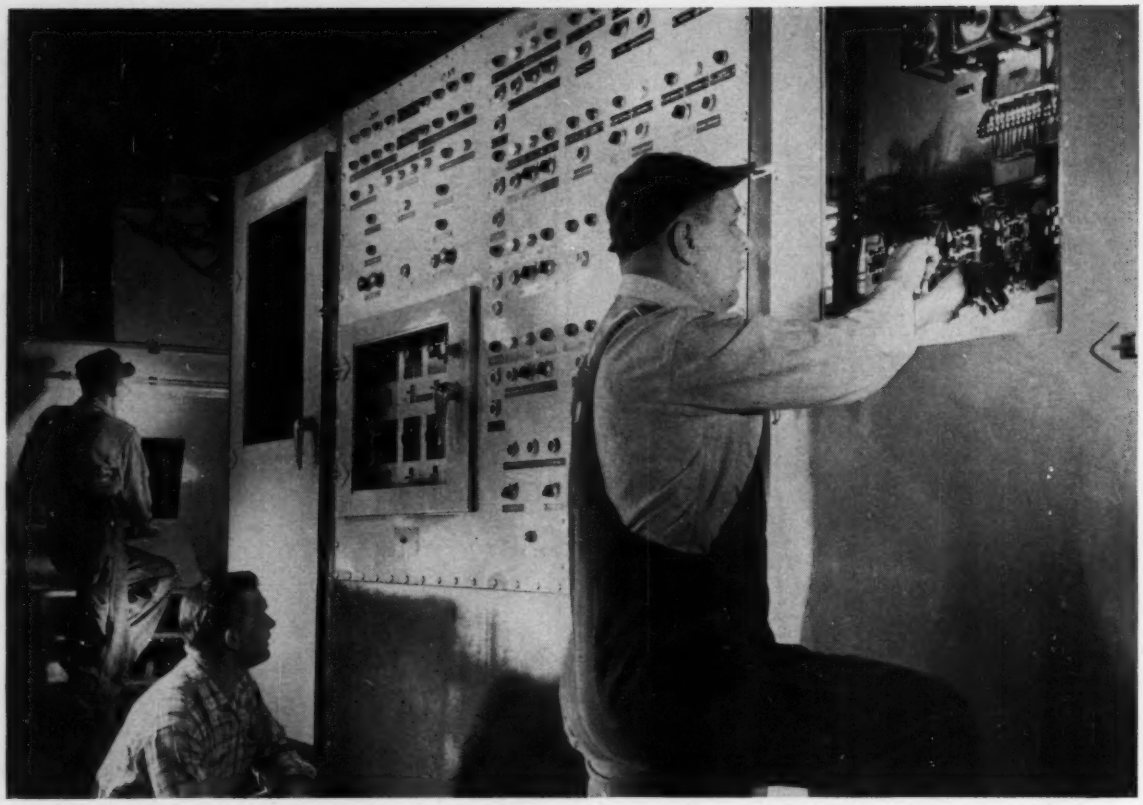
Our new facility is the first commercial ammonia plant east of the banks of the Mississippi River and south of Virginia and the first in the nation to be based entirely on coke oven gas. You will find it a dependable and economical source of supply.

Our strategic location in the geographic center of the Southeast enables us to serve many customers more expeditiously and at a substantial savings in delivery costs. Responsible joint ownership by two large, nationally known companies—Hercules Powder Company, Wilmington, Del., and Alabama By-Products Corporation, Birmingham, Ala.—assures maintenance of highest quality standards.

We appreciate the many orders that have been placed with us, even in advance of our plant's opening, and invite your inquiries. Phone, wire or write Alabama By-Products Corporation, Sales Agents, P. O. Box 354, Birmingham, Ala., Phone 7-5171.

KETONA

Chemical CORPORATION



Worked to death... to insure the life of your proportioning system

If there's anything worth its weight in gold in a proportioning system control panel, it's *dependability*. Before a single electrical component was designed into this panel being wired at Richardson Scale Co., its prototype had been literally worked to death in a controlled testing operation. It's survival of the fittest . . . and only the fittest is acceptable. Richardson's reputation as a producer of dependable control panels rests, in the last analysis, on the selection of tested components and on intensive and varied experience in applied electronics.

In addition, Richardson supplies each control panel completely wired and pre-tested, invites the customer to familiarize himself with it *before installation* and takes responsibility for complete system operation. Detailed instructions and diagrams are supplied for each job.

But this is only part of the story. The best of control panels will not pinch-hit for a poor automatic weighing unit, mis-applied materials feeding equipment or improper storage bin design. Richardson know-how in this field embraces 50 years of experience in handling over 400 materials.

When it comes to proportioning, you're in good company when you come to Richardson. Look at some of the others who now have *proportioning by Richardson:*

The Firestone Tire & Rubber Company • General Foods Corp. General Electric Company • U. S. Bureau of Mines Reynolds Metals Company • American Rice Milling Co., Inc. Union Carbide & Carbon Corporation • Ford Motor Co. Fleischmann Distilling Corp. • The Flintkote Company Johnson & Johnson • National Distillers Products Corp. Owens-Illinois Glass Co. • Pittsburgh Coke & Chemical Co. Celanese Corp. of America • Goodyear Tire & Rubber Co. E. I. Du Pont de Nemours & Co., Inc. • and many more.

Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

RICHARDSON SCALE COMPANY
Clifton, New Jersey

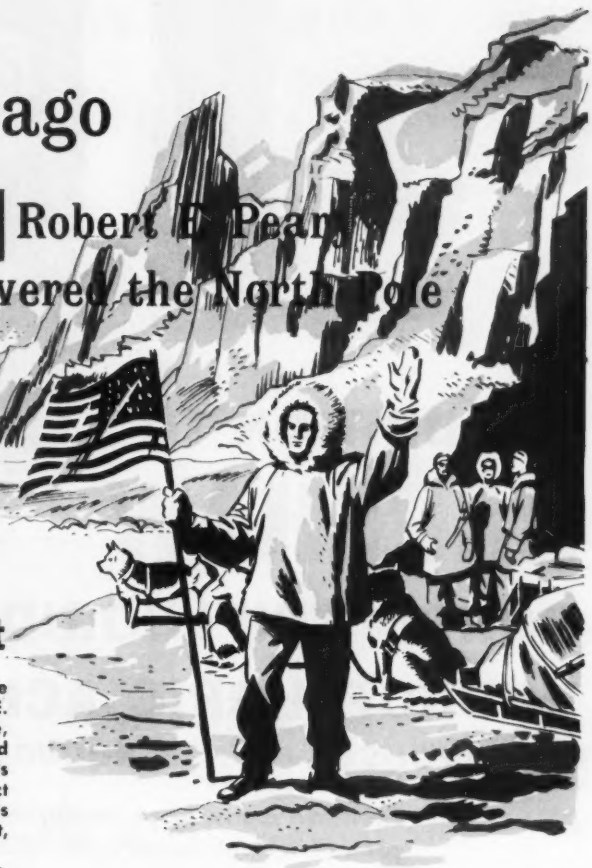
Atlanta • Boston • Buffalo • Chicago • Cincinnati • Detroit
Houston • Memphis • Minneapolis • New York • Omaha
Philadelphia • Pittsburgh • San Francisco • Wichita • Montreal
Toronto • Havana • Mexico City • San Juan

Richardson Scales S.A. 1-3 Rue de Chantepoulet, Geneva, Switzerland

2392

75 years ago

and 28 years before Robert E. Peary discovered the North Pole



Koven

was making individualized chemical equipment

Another tribute to American ingenuity and invention—the fact that, long before news was received that Robert E. Peary had placed the United States Flag at the North Pole, our country's chemical industry was making great forward strides in the development of new and improved methods of manufacture, and that KOVEN-built equipment, product of ever-increasing experience and skill, was providing this industry even then with the most efficient means to fast, economical production.

For your most efficient means to fast, economical production, for individualized equipment designed and constructed to fit your exact needs, call or write NOW for a trained KOVEN representative, and send for Bulletin #550. There's no obligation.

Tank Made of Steel

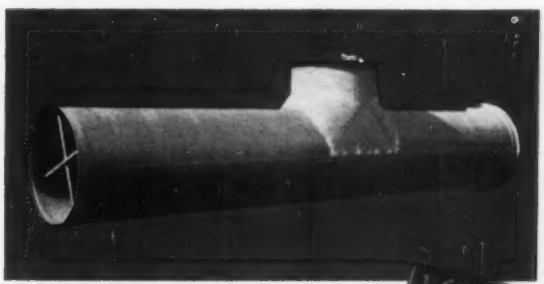
SPECIALISTS IN INTRICATE FABRICATION USING:

• STAINLESS STEEL • ALUMINUM
• MONEL • NICKEL • INCONEL
• ALL CLAD MATERIALS

Fabrication to all A.S.M.E. Codes

X-RAY INSPECTION FOR QUALITY CONTROL

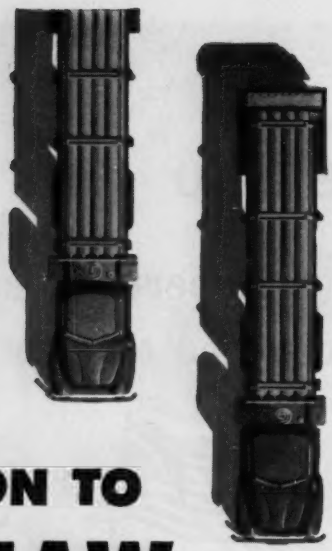
KOVEN equipment in all metals and alloys includes: High pressure vessels built to A.S.M.E., A.P.I. Codes, extractors, mixers, stills, kettles, tanks, stacks, breechings, hot transfer lines, light and heavy fabricated piping and plate exhaust ducts. Shop and field erected storage tanks to 2 million gallons. High vacuum testing on liquid oxygen storage tanks.

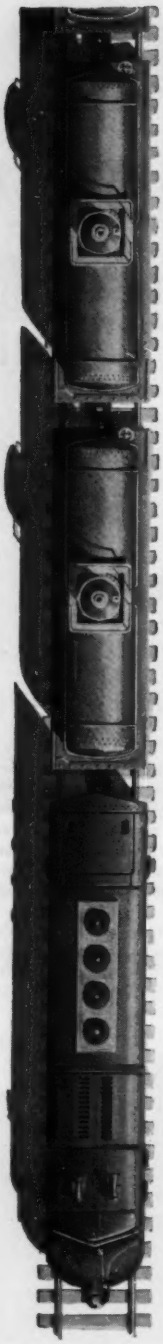


Steam, Water and Gas Piping

Koven *FOR INDIVIDUALIZED EQUIPMENT SINCE 1881*

L. O. KOVEN & BRO., INC., 154-A OGDEN AVE., JERSEY CITY 7, N. J.
***PLANTS:* JERSEY CITY, N. J. • DOVER, N. J. • TRENTON, N. J.**





IN ADDITION TO HARSHAW

BORON TRIFLUORIDE
HYDROFLUORIC ACID
anhydrous . . . aqueous

Here are many more production-controlled, high-quality fluorides:

- Ammonium Bifluoride
- Ammonium Fluoborate
- Antimony Trifluoride Sublimed
- Barium Fluoride
- Bismuth Fluoride
- Boron Trifluoride
- Boron Trifluoride Complexes
- Chromium Fluoride
- Copper Fluoborate
- Fluoboric Acid
- Fluorine Cells
- Fluorinating Agents
- Frosting Mixtures
- Hydrofluoric Acid Anhydrous
- Hydrofluoric Acid Aqueous
- Hydrofluosilicic Acid
- Lead Fluoborate
- Metallic Fluoborates
- Potassium Bifluoride
- Potassium Chromium Fluoride
- Potassium Fluoborate
- Potassium Fluoride
- Potassium Titanium Fluoride
- Silico Fluorides
- Sodium Fluoborate
- Tin Fluoborate
- Zinc Fluoborate
- Zinc Fluoride

THE HARSHAW CHEMICAL CO.

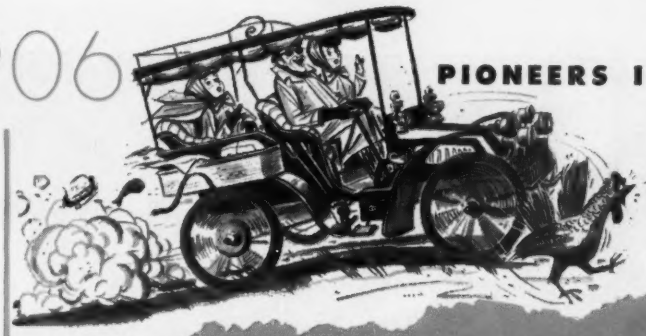
1945 East 97th Street • Cleveland 6, Ohio

Chicago • Cincinnati • Cleveland • Detroit • Houston
Los Angeles • Hastings-on-Hudson, N. Y. • Philadelphia
Pittsburgh

WRITE FOR

Harshaw's 40-page Book on Hydrofluoric Acid Anhydrous. It provides helpful data.

1906



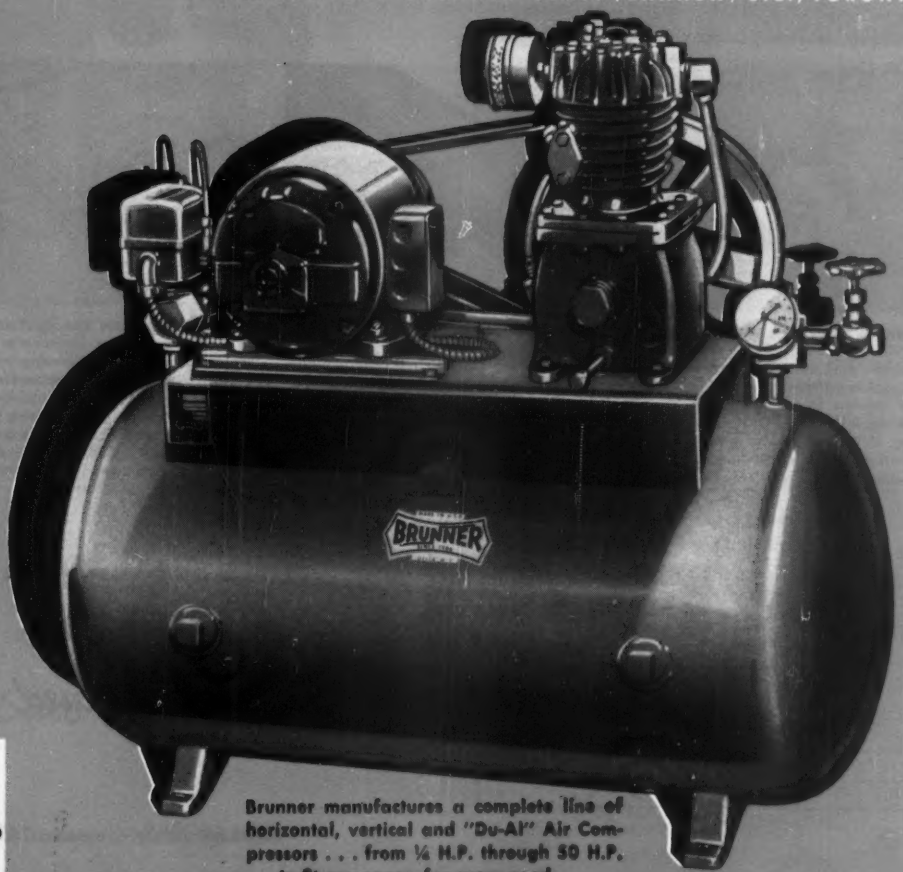
PIONEERS IN ENGINEERING PROGRESS

Introduced in 1906 . . . the first Brunner air compressor, like the "horseless carriage", was an engineering achievement of the times.

TODAY . . . Tested by the past . . . choose BRUNNER for the future!

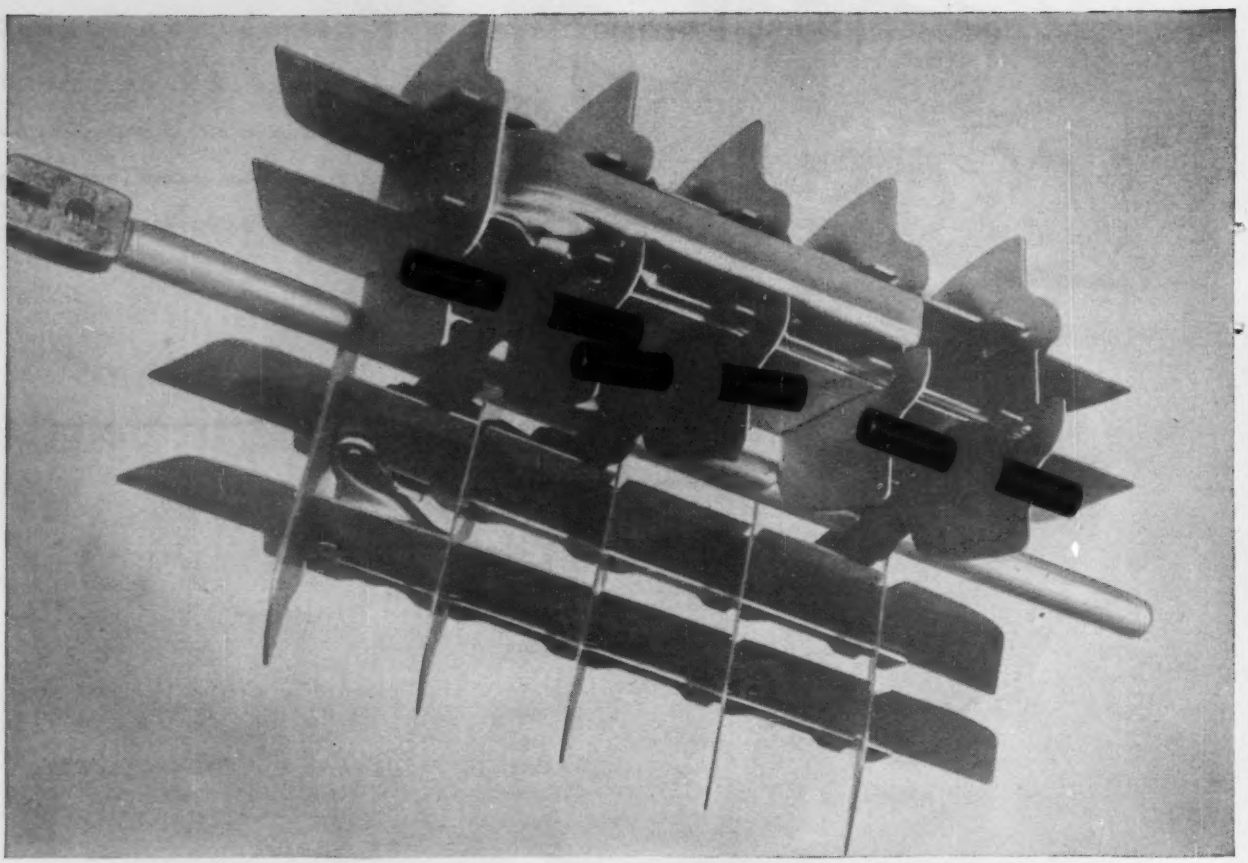
There's a Brunner Air Compressor for every job that requires compressed air.

BRUNNER MANUFACTURING COMPANY, UTICA, N. Y.
THE BRUNNER CO., GAINESVILLE, GA.
IN CANADA: BRUNNER CORP. (CANADA) LTD., TORONTO, ONTARIO

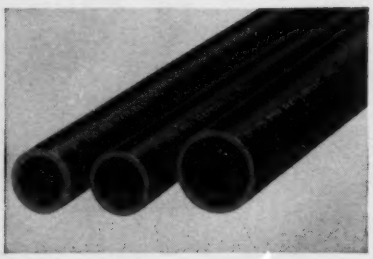


Brunner manufactures a complete line of horizontal, vertical and "Du-Al" Air Compressors . . . from ¼ H.P. through 50 H.P. . . . to fit any space, for every need.

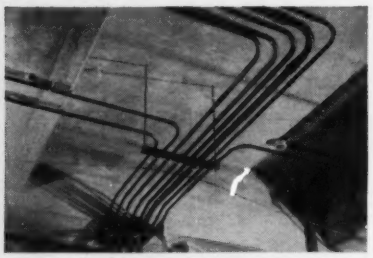
PROVEN QUALITY
50th Anniversary
BRUNNER
DEPENDABLE



CORROSIVE HEADACHES RELIEVED IN ASPIRIN PLANT with Republic ENDURO Stainless Steel. Because the chemicals, salycilic acid and acetic anhydride used in making aspirin powder attack ordinary metals, ENDURO Stainless Steel is used here for all equipment coming in contact with the powder during processing. If your equipment must resist corrosion and protect product quality and color, then specify Republic ENDURO Stainless Steel.



PERIODIC AND COSTLY PIPE REPLACEMENTS REDUCED with Republic's new plastic pipe — Semi-Rigid Kralastic. Extremely tough, it will absorb punishment without breaking or shattering and is highly resistant to most corrosive liquids and gases. Kralastic is ideally suited for both waste and process lines in the food processing and chemical industries. It is non-toxic. It's easy to handle, easy to join. Available in a wide range of working pressures.



DOUBLE PROTECTION FOR ELECTRICAL RACEWAYS in extremely corrosive atmospheres is provided by the tough, polyethylene coating over the galvanized finish of Republic Dekoron-Coated Electrical Metallic Tubing. Installation is simple. Moisture-tight joints are easily made, using threadless connectors and couplings. Joints are sealed with tape. Republic Dekoron-Coated E.M.T. reduces replacement costs. Cuts down-time of costly equipment. It costs less because it lasts longer.

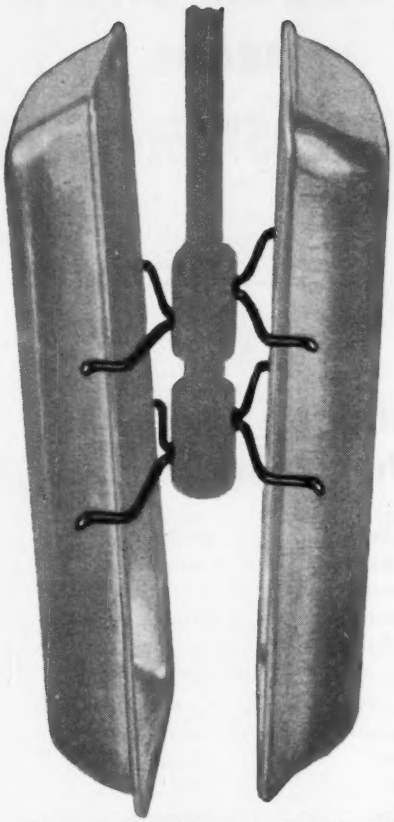
REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

REPUBLIC TITANIUM

displaces aluminum and increases anodizing rack life 100 times



Experimental anodizing racks utilizing Titanium have proved so successful that plans are being made for quantity production. New design will take full advantage of the properties of Titanium for the entire assembly.

Up to now, aluminum has been considered to be the most satisfactory rack material for the anodizing of ice trays and grids.

But, its use has been expensive and time consuming. For example, prior to each anodizing cycle a stripping operation is required to remove the anodic film formed for electrical contact on the previous cycle. And, during each anodizing and stripping cycle a considerable amount of aluminum is dissolved from the racks.

Recently one manufacturer of ice trays and grids switched to commercially pure Republic Titanium for use in anodizing racks. Titanium has proved to be an excellent rack material. It not only resists the chemical attack of the cleaning, etching, brightening and anodizing solutions, but also eliminates the need for the stripping operation. The thin, adherent oxide formed will conduct electricity and, therefore, does not have to be stripped off after each anodizing cycle.

While the initial cost of Titanium is higher than that of the former material, elimination of the stripping operation and increased rack life more than compensates for the increase in cost. The manufacturer's laboratory tests indicate that rack life will be increased more than 100 times.

Does this give you an idea for chemical equipment or for low-maintenance metal parts that must stand up to the most severe service? Then talk it over with Republic. You'll get complete information from the experienced leaders in corrosion-resistant metals.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
3116 East 45th Street, Cleveland 27, Ohio

Please send more information on these Republic products:

☐ Titanium & Titanium Alloys
☐ ENDURO® Stainless Steel ☐ Semi-Rigid Kralastic
☐ Dekoron®-Coated E.M.T.

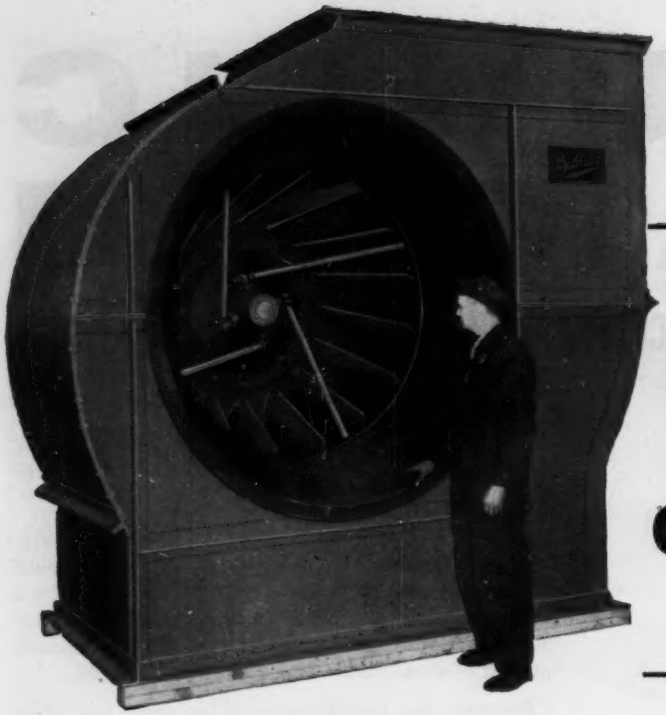
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

C-1087



RUBBER-LINED MEANS CORROSION-SAFE

"BUFFALO" RUBBER-LINED FUME EXHAUSTERS

Because corrosive fumes cannot react on surfaces they do not contact, these fans last many times as long as ordinary steel exhausters.

Rubber is vulcanized to the inlet, shaft, rotor and inside of housing of these "Buffalo" Exhausters. Strength of adhesion is over 700 lbs. per square inch, with no seams or cracks where corrosive fumes can penetrate. And due to the resiliency of the rubber, there is no possibility of separation, hardening or cracking from differences in expansion. Savings in fan parts and down-time pay for the extra cost of the rubber in a hurry.

This is just one of a variety of "Buffalo" Fans you may order rubber-lined. We also build fans in stainless steel, or with a choice of other protective coatings on request — all with the famous "Q" Factor* of efficient, smooth, long-lived performance that has made "Buffalo" the top fan buy for 79 years.

handling these and other fumes:

Sulphuric	Oxalic
Sulphurous	Tartaic
Carbonic	Formaldehyde
Hydrobromic	Muriatic (Hydrochloric)
Hydrofluocilcic	Zinc Sulphate
Hydrofluoric	Ferrous Chloride
Phosphoric	Caustic Potash
Pyroligneous	Calcium Hypochlorite
Acetic	Copper Sulphate
Citric	Zinc Chloride
Tannic	Ferrous Sulphate
Chlorine	Sodium Acid Sulphate

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

WRITE FOR BULLETIN 2424F TODAY!

"Buffalo"

BUFFALO FORGE COMPANY

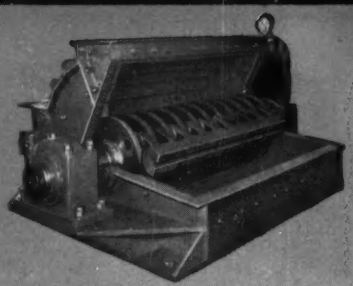
501 BROADWAY, BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

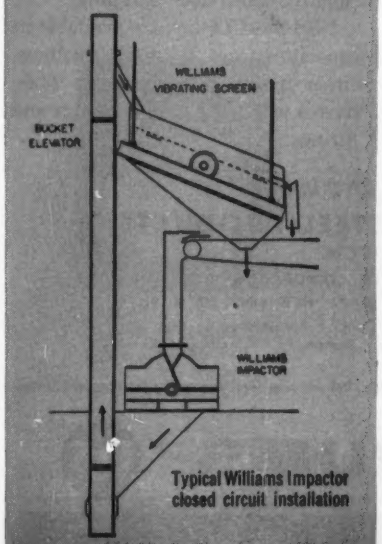
VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Lowest-Cost Crushing

with better product control



Open view showing hammers and impact blocks. Extremely rugged, heavy construction of steel plate with manganese steel liners, hammers and impact blocks. Extra large shafts are mounted in oversize bearings sealed in self-aligning housings.



Typical Williams Impactor closed circuit installation

WILLIAMS *Reversible* IMPACTOR

By properly controlling the forces of speed and mass in size reduction operations, Williams Impactors offer the lowest possible cost-per-ton in producing top quality materials from 2" down to 35 mesh with a minimum of fines . . . or much smaller where more friable products are handled. In closed circuit systems with external vibrating screens, a single Impactor promises 100% product sizing with surprising economy, even with the most difficult specifications.

No grates are required, hence no replacement expense of these parts is necessary. Quick, uniform reduction, sizing and discharge from the mill eliminates any grinding attrition action that causes excessive wear, especially if raw materials are highly abrasive. Reversible rotation eliminates manual turning of hammers and minimizes down time. Impact blocks are also reversible which further reduces cost. Parts last up to 7 times longer than in other types of equipment. Unusually low maintenance is a feature of the Impactor.

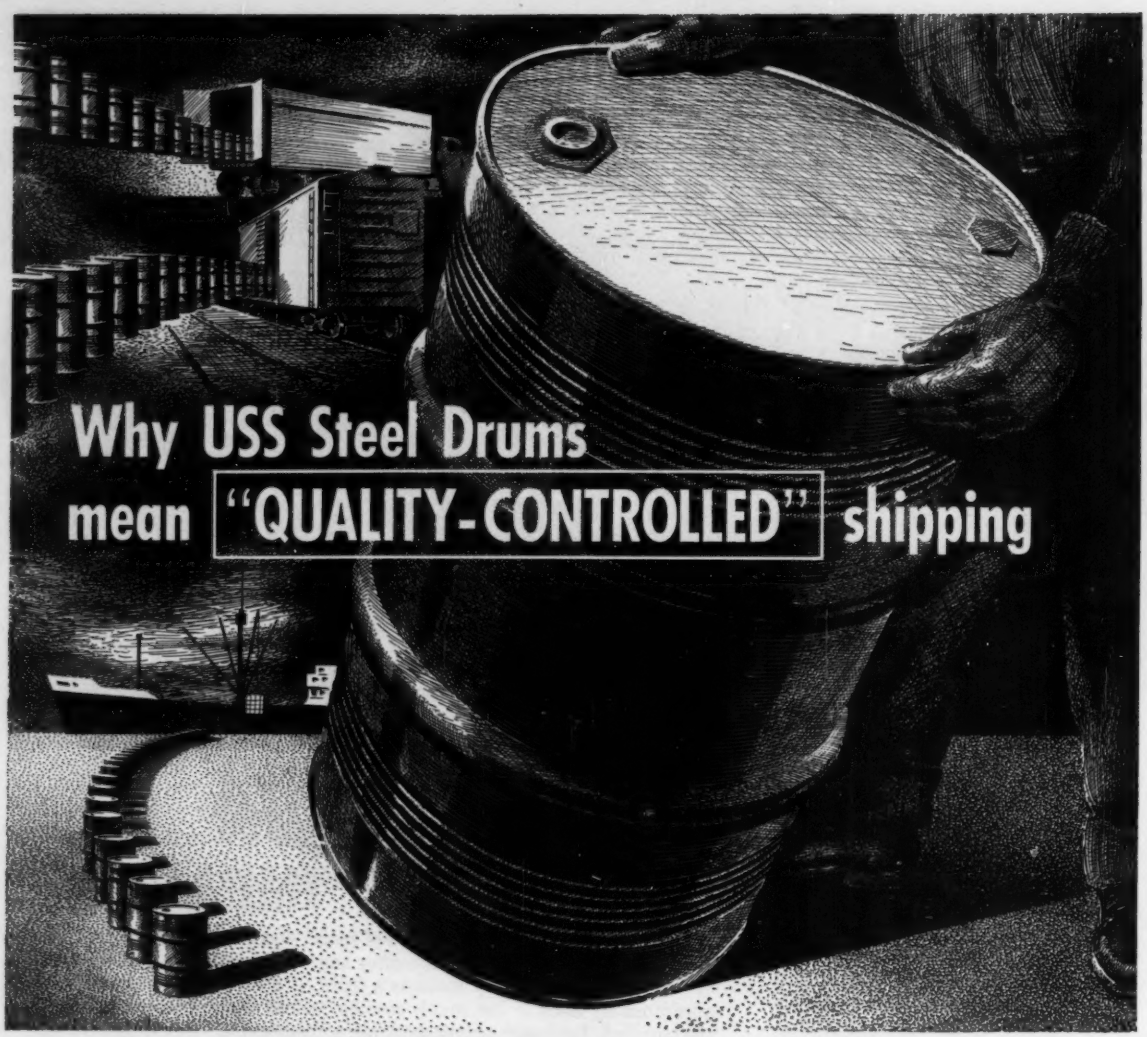
You have much to gain in lower costs and better product quality control with an Impactor. *Write for literature.*

WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 N. 9th St. St. Louis 6, Mo.

WILLIAMS
CRUSHERS GRINDERS SHREDDERS

Hammer Mills Helix-Seal Mills Roller Mills Air Separators Vibrating Screens Feeders

OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD



There's no need for your rigid quality control measures to end when your product leaves the plant on its way to your customer. Not when you ship in USS Steel Drums. That's because every USS Steel Drum is carefully processed to insure *your* product purity.

To provide this type of protection from contamination, every trace of grease and dirt is removed from the drum body and ends with a strong alkali solution. With all impurities removed, the interior and exterior are thoroughly saturated with a special phosphate formula that gives long-lasting protection from rust. Take advantage of our concern for your product. Plan to give your products the important protection of "quality-controlled" shipping.

USS Steel Drums are available in capacities from 2½ to 110 gallons, either plain or decorated. They have a wide variety of openings and fittings.

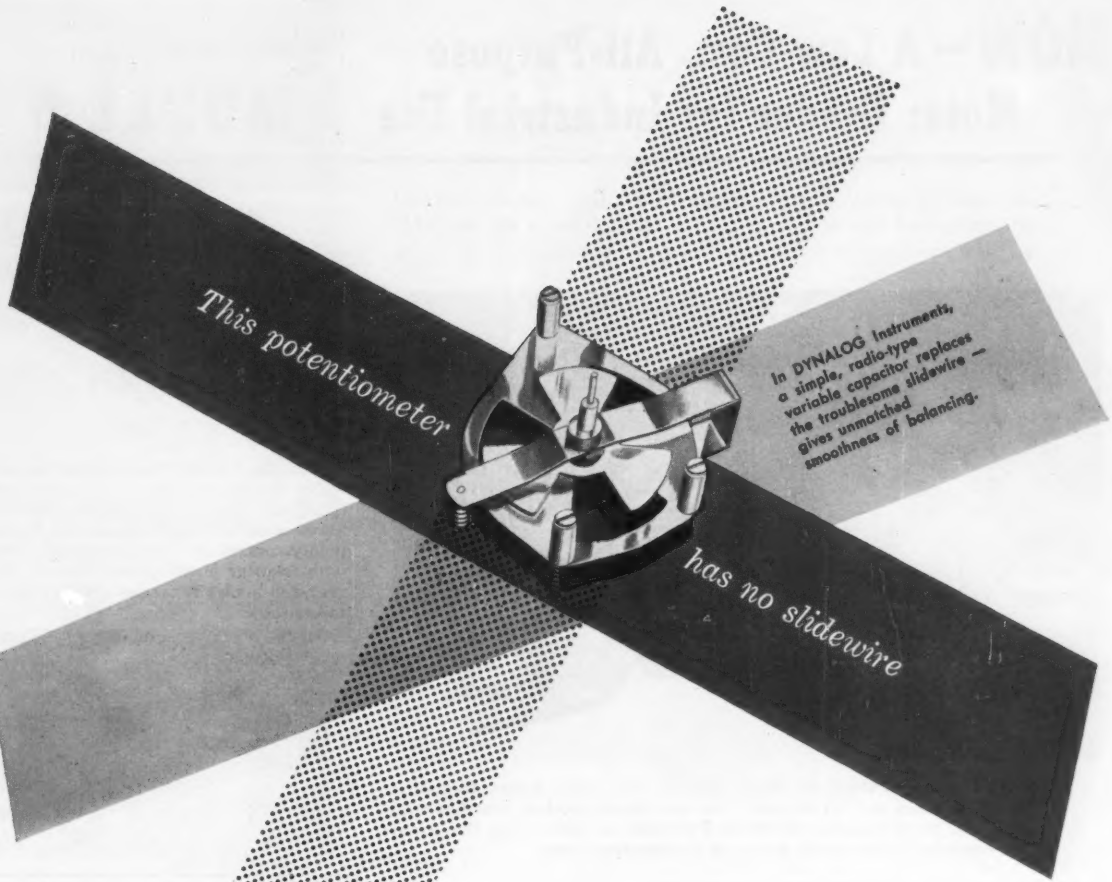
"It's Better to Ship in Steel"

UNITED STATES STEEL PRODUCTS
DIVISION
UNITED STATES STEEL CORPORATION
DEPT. 226, 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Los Angeles and Alameda, Calif. • Port Arthur, Texas
Chicago, Ill. • New Orleans, La. • Sharon, Pa. • Camden, N. J.

SEE The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

USS STEEL DRUMS

UNITED STATES STEEL


This potentiometer
has no slidewire
In DYNALOG Instruments, a simple, radio-type variable capacitor replaces the troublesome slidewire — gives unmatched smoothness of balancing.

STEPLESS CAPACITY-BALANCING
ELIMINATES STANDARDIZING!

DYNALOG'S EXCLUSIVE BALANCING ACTION

- no slidewire
- no batteries
- no standardizing
- no gears, cables, etc.
- no high-speed reversing motor

Here's the potentiometer that's *never* "off process" for standardizing. It requires none! The Dynalog's advanced, stepless-balancing design eliminates dry cell, provides *direct, uninterrupted* evaluation of the measured variable with sustained high accuracy.

Dynalog* design eliminates slidewire maintenance and motor servicing too! A simple, variable capacitor and positive magnetic drive provide smooth, continuous balancing action . . . instant response without wear. There are no fast-moving parts . . . no gears, cables, or complicated mechanisms. Only five moving parts, including the recording pen!

Dynalog Instruments are available for use with resistance, voltage, capacity, or inductive type primary elements to measure and/or control any process variable. For complete details, write for Bulletin 427. The Foxboro Company, 362 Neponset Ave., Foxboro, Mass., U.S.A.

*Reg. U. S. Pat. Off.

FOXBORO DYNALOG
Reg. U.S. Pat. Off.
ELECTRONIC INSTRUMENTS

NOW — A Low-Cost, All-Purpose Motor Grader for Industrial Use

The Allis-Chalmers

MODEL D

Outstanding ability, almost unlimited versatility, and original cost only one-third that of a large grader, all help make the Model D an ideal machine for use around industrial plants.

HANDLES CONSTRUCTION of roads, parking lots, plant yards. It grades, backfills, levels and landscapes, cuts and cleans ditches, scarifies with plenty of down pressure, works and spreads oil mix — has the power and capacity to do a wide range of construction jobs.

CLEARS AWAY SNOW from large areas, sidewalks, drives — helps keep winter operations on schedule. (*Above*) The Model D moves snow with interchangeable, hydraulically-controlled V or blade-type plow or with regular moldboard. (*Below*) With rear-end loader it carries snow or loads it to trucks.

MAINTAINS ROADS AND YARDS. The Model D smoothes out access roads, plant drives, storage yards, parking lots. It removes weeds and brush, handles patching work, reshapes and maintains shoulders—keeps roads and yards in shape the year round.

STOCKPILES, LOADS sand, dirt, any bulk material or feeds conveyors with ⅝-yd hydraulically-controlled bucket. Dumping height of 8 ft, 8½ in. allows easy loading of high truck bodies, hoppers, bins.

LET YOUR DEALER DEMONSTRATE how the economical Model D can handle a variety of jobs for *you* — or send for complete information.

Features Behind the Model D's Outstanding Ability

PLENTY OF POWER. Modern 50 brake-hp "POWER-CRATER" engine provides unusual lugging ability even at part throttle for best all-round performance. Choice of gasoline or diesel power. Engine is not only powerful, but dependable and economical to use. Parts and service available everywhere.

BIG-GRADER ADVANTAGES include single-member tubular frame that absorbs stresses and strains, ground-gripping tandem drive for best traction, hydraulic blade lift to make operator's work easier, ROLL-AWAY moldboard for moving more dirt with less effort.

SPECIAL FEATURES HELP PERFORMANCE. (optional equipment). Leaning front wheels make possible better control, greater handling ease. Hydraulic blade shift speeds work around obstructions, power circle turn permits turning blade up to 135 degrees with easy lever control.

POWER-CRATER and ROLL-AWAY are Allis-Chalmers trademarks.

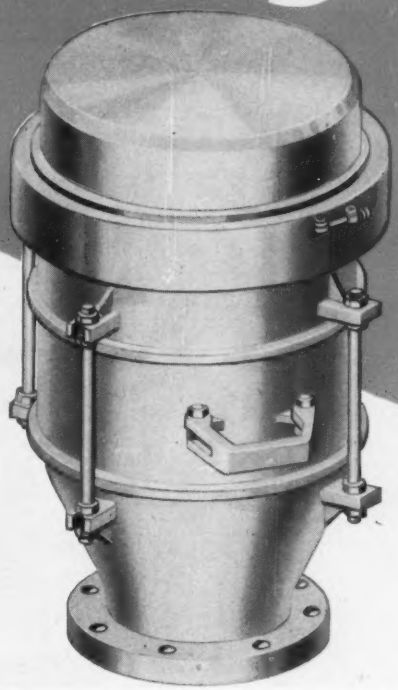
Choice of Two Models

	Diesel	Gasoline
Brake hp	50	50
Weight	9,350 lb	8,800 lb
Speeds to	25.2 mph	25.6 mph

ALLIS-CHALMERS

Introducing...

A New Lightweight BS&B Tank Vent And Flame Arrestor *



FEATURES

1 High Capacity

. . . high capacity pressure and vacuum relief comparable to the flow of an open nozzle.

2 Vapor-Tight

. . . one seal only — flexible, positive, replaceable.

3 Rugged with Light-weight Construction

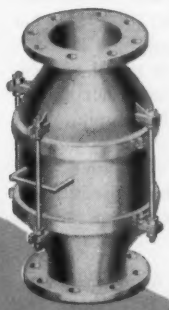
. . . superior design and use of quality materials have resulted in a lighter weight vent.

* PATENT PENDING

The BS&B Type 76-17 Arrestor Vent is a combination vent and cartridge type flame arrestor to prevent the spread of an external flame into the storage tank while venting. The topworks is identical to the Type 76-16 vent (described below), with a modified base to fit the top of the flame arrestor. Clamping edges are interchangeable to allow continued operation of the vent when the arrestor section is removed. Arrestor vents are available in sizes 4" through 12" and mount to ASA bolting circles. Pressure and vacuum settings start at ½ ounce per square inch.

The BS&B Type 76-16 Tank Vent is a lightweight venting device for atmospheric storage tanks containing volatile fluids, and features a floating seal which provides positive shut-off under both pressure and vacuum. This seal consists of two flexible diaphragms which contact valve seats. Easy access is provided to it by a quick-opening V-clamp which holds the cover in place. These vents mount to ASA bolting circles in sizes 4" through 12". Pressure and vacuum settings start at ½ ounce per sq. in.

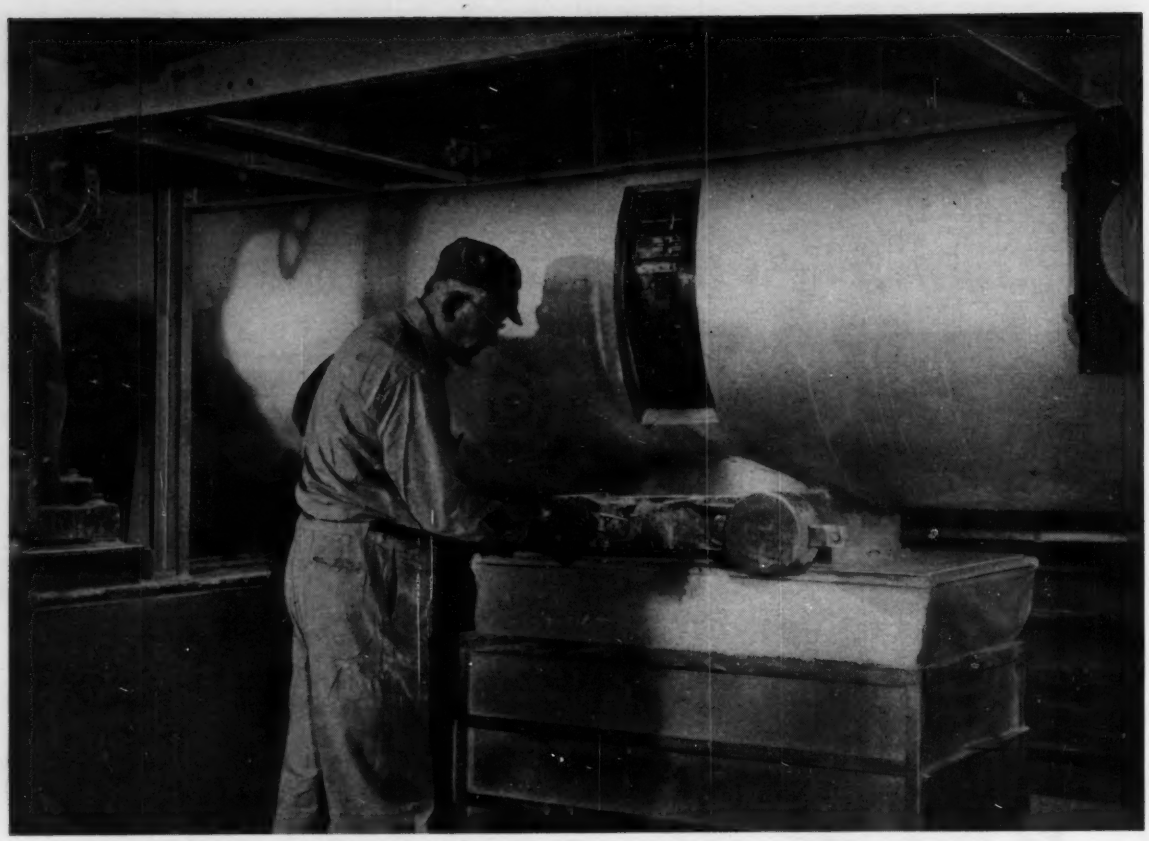
The BS&B Type 76-18 In-Line Arrestor is for a free vent system, requiring a flame arrestor to protect vent lines on process vessels when the emitted vapors are explosive or ignitible. End flanges are 150 lb. ASA in sizes 4" through 12".



EFFICIENCY BS&B RELIABILITY — ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

Your BS&B Representative will be glad to give you detailed information. Or you may write to . . .

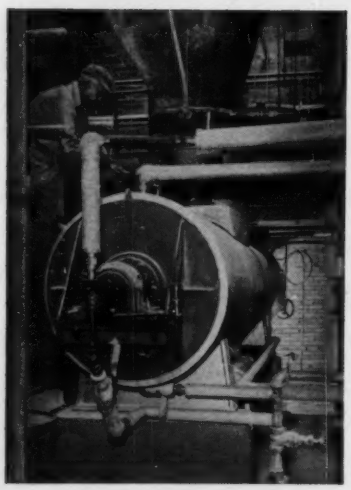
BLACK, SIVALLS & BRYSON, INC.
Controls Division, Dept. 2-N2
7500 East 12th Street — Kansas City 26, Missouri



G-11® (brand of hexachlorophene) is dried uniformly to less than 1% moisture content in Stokes rotary vacuum dryers

STOKES rotary vacuum dryers vital to processing of G-11®

Sindar product dried at low temperatures on round-the-clock production schedule.



Two Stokes rotary dryers run 24 hours a day at the Givaudan plant in Delawanna, N. J.

In the fight against bacteria, G-11® (brand of hexachlorophene), developed by the Givaudan Corporation and marketed by its associate, Sindar Corporation, is doing for the skin what antibiotics are accomplishing in internal medicine. From an initial application in operating room "scrub-up" soaps, the product has found ever-widening application in cosmetics where its unique "cleanliness that clings" gives valuable antiseptic and deodorant qualities to creams, lotions and soaps.

Because of the need for low-temperature drying, laboratory and pilot-plant investigations with G-11® were carried out in Stokes vacuum shelf dryers. To meet the growing demand for this product, two Stokes vacuum dryers now operate 24 hours a day.

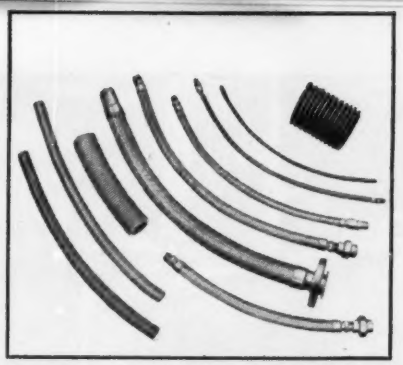
Stokes has had vast experience in the design and application of chemical processing equipment. Your particular problem will receive careful consideration, based on this broad background.

For an informative brochure on Vacuum Drying, write for Catalog 720. For complete information on how the Stokes Advisory Service and Laboratory can help you, send for Bulletin 640.

F. J. Stokes Machine Company, Philadelphia 20, Pa.

OFFICES IN PRINCIPAL CITIES, REPRESENTATIVES THROUGHOUT THE WORLD

STOKES



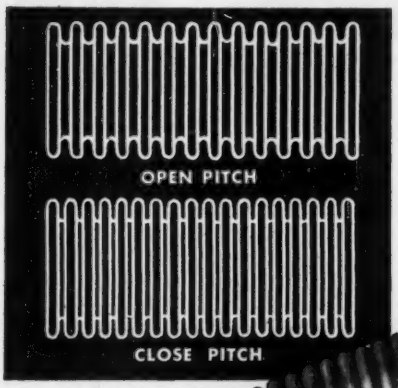
Typical American Stainless Steel Tubing and assemblies designed and manufactured for specific service conditions.

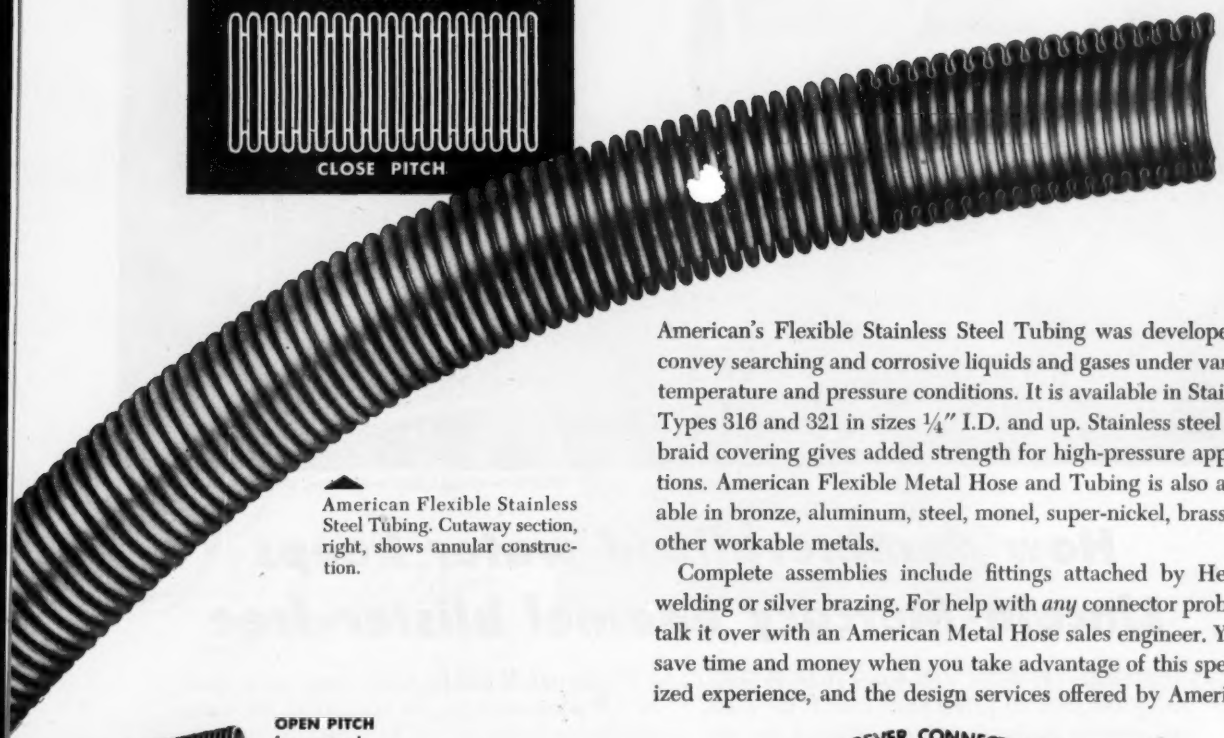
To convey high-temperature, high-pressure CORROSIVE gases and liquids...

AMERICAN'S

FLEXIBLE STAINLESS STEEL TUBING

stands up under continuous flexing
absorbs severe vibration
compensates for misalignment
is easily installed





American Flexible Stainless Steel Tubing. Cutaway section, right, shows annular construction.

American's Flexible Stainless Steel Tubing was developed to convey searching and corrosive liquids and gases under varying temperature and pressure conditions. It is available in Stainless Types 316 and 321 in sizes ¼" I.D. and up. Stainless steel wire braid covering gives added strength for high-pressure applications. American Flexible Metal Hose and Tubing is also available in bronze, aluminum, steel, monel, super-nickel, brass and other workable metals.

Complete assemblies include fittings attached by Heliarc welding or silver brazing. For help with *any* connector problem, talk it over with an American Metal Hose sales engineer. You'll save time and money when you take advantage of this specialized experience, and the design services offered by American.

55177

OPEN PITCH for general service

CLOSE PITCH for extra flexibility, frequent movement, excessive vibration

STAINLESS STEEL BRAID gives added strength for high-pressure service

ASSEMBLIES made up to your specifications complete with fittings attached

WHEREVER CONNECTORS MUST MOVE

AMERICAN FLEXIBLE METAL HOSE AND TUBING

AN **ANACONDA®** PRODUCT

FREE FOLDER!

Four-page folder gives engineering data on construction and types. Includes pressure ranges, bending diameters, weights, data on fittings.

Write *today* for your copy. *Please print.*

The American Brass Company, American Metal Hose Division
Waterbury 20, Connnecticut.

CE

Please send me a copy of Bulletin STC-1, "Flexible Stainless Steel Tubing by American."

NAME.....

COMPANY.....

STREET.....

CITY.....ZONE.....STATE.....

Photo courtesy Lincoln-Mercury Division, Los Angeles

How demineralized water keeps Lincoln-Mercury enamel blister-free

Auto bodies get rinsed with water after phosphatizing and after the prime paint coat. If the water contains too much salt, it leaves deposits that can cause pinhead blisters in the finished paint job. So when paint chemists at Lincoln-Mercury's Los Angeles plant checked and found that the waterwork's newest well was "salty," they took action.

They investigated drilling a new well and laying pipe to a better well. But these methods don't provide a permanent solution because the character of a well water often changes (with the level of the water table, etc.).

That's why Lincoln-Mercury decided to remove *all* mineral salts from their rinse water. To do this at low cost, they chose a Permutit Demineralizer (2 cation exchangers, 2 anion exchangers, 2 decarbonation tanks).

This Permutit Demineralizer keeps water quality uniformly high despite changes in the water supply. It actually delivers water as mineral-free as commercially distilled water. The results: beautiful finishes that stay blister-free.

Unvarying high-grade water may solve your quality-control problem. Let us help you get it at low cost. Write: The Permutit Company, Dept. CE-2, 330 West 42nd St., New York 36, New York.

PERMUTIT®
ION EXCHANGE
for Water Conditioning • Chemical Processing

Liquid Assets

CARRIED BY MODERN TANK CAR SERVICE!

Whatever your "liquid assets" are, you can look to Shippers' Car Line for prompt, low-cost transportation. The reasons are simple: The world's most *modern* equipment—the revolutionary DURADOME tank car is leased and sold exclusively through Shippers'. A network of *modern* repair shops—strategically located to keep your cars in top shape. 35 years of *specialized* experience in the operation and maintenance of tank car fleets for industry.

Whether you prefer to buy or lease, you'll benefit from a talk with your Shippers' representative...

SHIPPERS' CAR LINE CORPORATION

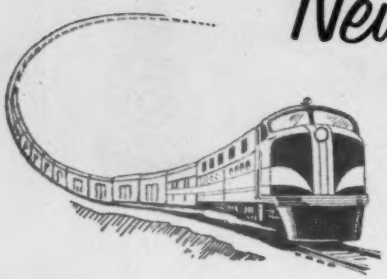
A subsidiary of acf INDUSTRIES, Incorporated

30 Church Street, New York 7, N. Y.

CHICAGO, ILL. • HOUSTON, TEX. • SAN FRANCISCO, CAL. • MILTON, PA. • EAST ST. LOUIS, ILL. • SMACKOVER, ARK. • TULSA, OKLA. • NORTH KANSAS CITY, MO.

Every minute 2,281,623 cu. ft. of air handled by CLARAGE in

New York's new Coliseum



...enough to fill a train of boxcars 5½ miles long

One of the biggest air handling assignments on record — and Clarage all the way!

For the Coliseum's colossal requirements, 75 Clarage Fans, 24 Unicoil Sprayed Coil Units, and 14 Multitherm Conditioning Units were selected. This choice, we feel, is an outstanding tribute to the worth of our equipment. Obviously, in a structure of this type, there could be no compromise with quality. Only the finest could qualify.

Make sure *your* investment in air handling and conditioning is a profitable one. Investigate the equipment we have perfected for every type of application.

CLARAGE FAN CO., Kalamazoo, Michigan

OWNER — Triborough Bridge & Tunnel Authority
ARCHITECT — Leon and Lionel Levy
MECHANICAL ENGINEER — Guy B. Panero
STRUCTURAL ENGINEER — Dr. Jacob Feld
GENERAL CONTRACTOR — Walsh-Fuller-Slattery
HEATING, VENTILATING AND AIR CONDITIONING CONTRACTOR — Almirall & Co., Inc.

CLARAGE

...dependable equipment for making air your servant

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

FAMOUS LIGHTHOUSES OF AMERICA

FOWEY ROCKS LIGHTHOUSE is situated on the outer reefs 11 miles southeast of Miami, Florida. Built in 1878, it is of iron pile construction and stands in 4 feet of water with the light itself 110 feet above water. Fowey Rocks Lighthouse is one of a series of great offshore lighthouses that have made navigation safer and helped to eliminate an infamous wrecking industry that once thrived along the dangerous Florida Reefs.

Greater Safety and true guidance in the use of electrochemical products have always been important factors in the service Niagara Alkali Company offers to its customers. You can always depend on the quality of Nialk® Liquid Chlorine, Nialk Caustic Potash, Nialk Carbonate of Potash, Nialk Paradichlorobenzene, Nialk Caustic Soda, Nialk TRICHLORethylene, Niagathal® (Tetrachloro Phthalic Anhydride).

NIAGARA ALKALI COMPANY

60 East 42nd Street

New York 17, N.Y.

One of six 51-foot liquid chlorine horizontal storage tanks built and tested by Newport News to meet A.S.M.E. Code requirements. This pressure vessel was welded by Union melt machines. Pressure vessels undergo stress-relieving treatment in our ovens.

Large Units . . .

single or multiple

Built with careful attention to detail by specialists in Metal Fabrication

Whether specified in alloyed or carbon steel, stainless, high nickel alloys or clad . . . you'll find it pays to have Newport News fabricate your large units.

Avail yourself of the specialized production techniques, and the skill of Newport News craftsmen operating vast steel fabricating shops.

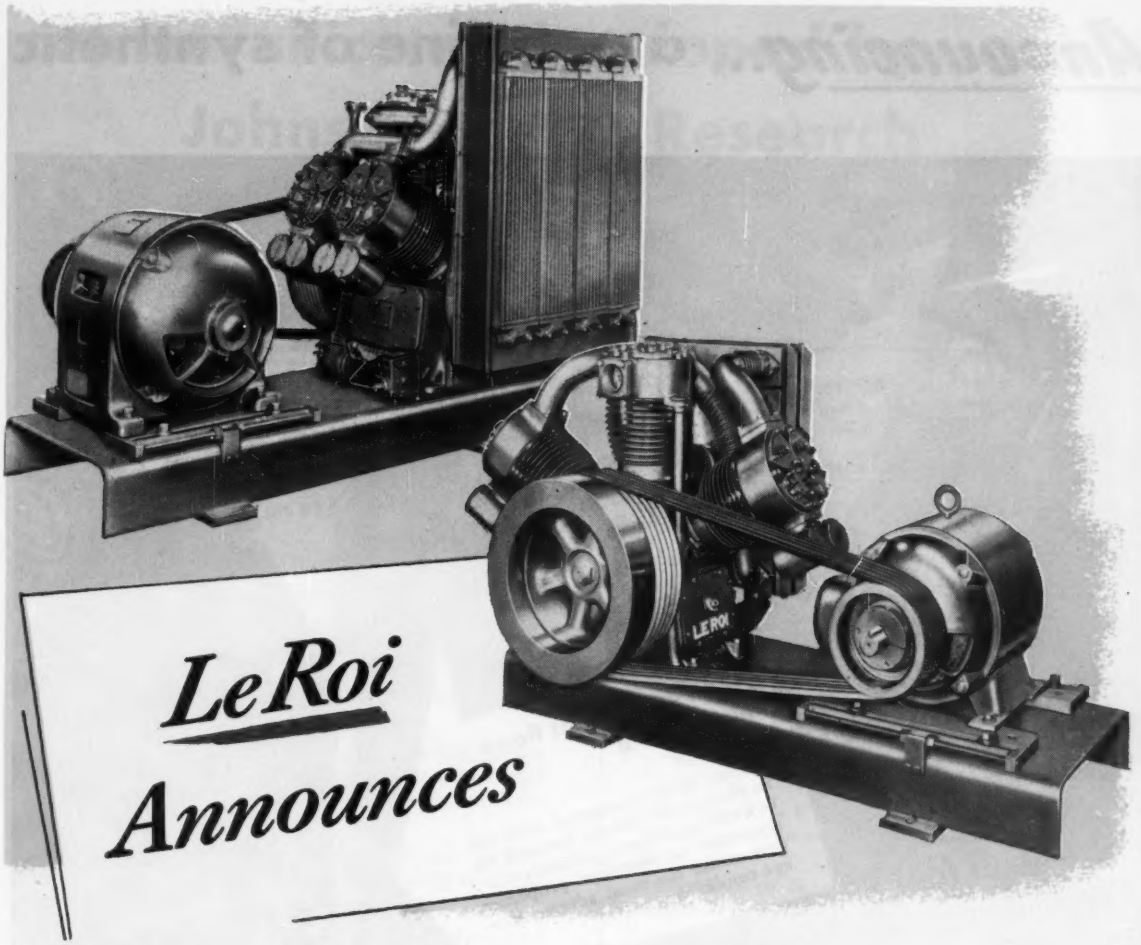
Units of large dimension are readily constructed by Newport News in a 225-acre plant that includes five huge, fully equipped machine shops, drop forging and die facilities, heat treating ovens, and acres of brass, iron and steel foundries.

Moreover, modern testing apparatus, used for thorough investigation of materials and techniques, contributes to the excellence of Newport News fabrication. In addition, Newport News shop erection of fabricated units assures trouble-free assembly at your plant site.

Let us bid on your present or future projects. If you are not familiar with the way Newport News can help you, write for our booklet entitled *"Facilities and Products"*. . . it's yours for the asking.

Newport News **Shipbuilding and Dry Dock Company**

Newport News, Virginia



LeRoi Announces

Three New Stationary Compressors

Two-stage air-cooled units in 50, 75, and 100 hp. sizes having 200, 330, and 440 cfm capacities at 125 lbs. pressure

Now, Westinghouse Air Brake Co., through its Le Roi Division, adds three new compressors to its stationary line, giving you a size range from ½ to 100 hp. Built to give you years of service, these new compressors are designed to provide you with many important benefits — benefits that mean low-cost air for your plant, mine, quarry, ship, or construction job.

Low-cost operation — Good mechanical and compression efficiency resulting from 2-stage compression and intercooling keeps power costs to a minimum. Moreover, since these new Le Roi's are air-cooled, cooling-water cost is eliminated and attention on the part of the operator is greatly reduced.

Low-cost installation — Compact size reduces headroom and floor space requirements. Again, air cooling eliminates the need for water and water piping so that you can install these units practically anywhere with no fear of freezing. Minimum vibration and light weight lets you bolt them to a substantial floor and save on foundation costs.

Low-cost maintenance — All valves are interchangeable, both intake and discharge. Shrouded-type intercooler and large air passages promote longer valve life. No anti-freeze is required and there are no cylinder jackets or intercooler water passages to clog or scale. Forced-feed lubrication supplies oil under pressure to all moving parts and a sight-level oil gauge keeps the operator posted on the oil supply. The crankshaft is suspended on taper roller bearings that seldom need adjustment, and all parts are easily accessible.

Dual control is standard equipment and permits either constant-speed or automatic start-and-stop regulation. Here's a practical answer to low-cost air supply. Write for our latest literature.

SC-100

LE ROI Division of Westinghouse Air Brake Co.

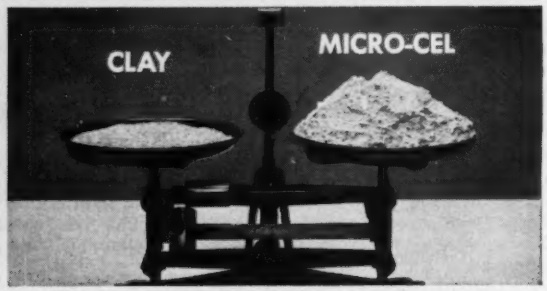
MILWAUKEE 1, WISCONSIN

Distributors in all principal cities

Announcing... a new line of synthetic

The powder that flows like a liquid
Micro-Cel (as compared with clay in photo) will greatly improve the flowability of many products . . . maintains its free-flow properties even under the most adverse storage conditions.

Absorbs up to 6 times its weight in water—Micro-Cel remains a free-flowing powder even after absorbing more than twice its own weight of liquid.



High bulk . . . loose weight density as low as 5 lb. per cu. ft.—Micro-Cel "fluffs up" any compound with a minimum addition.

Johns-Manville MICRO

calcium silicates developed by Johns-Manville Research

MICRO-CEL...

Check its different combination of properties . . . it may hold the key to lower costs and product improvements in your process formulations.

Johns-Manville's new Micro-Cel line can produce many desirable effects as the following examples illustrate.

Absorption of Liquids—Micro-Cel will absorb 1 to 2½ times its weight of liquids and still remain a free-flowing powder.

Uniform Dry Dispersion—Different Micro-Cel grades with particle sizes as low as .02 microns and particles of rounded to spherical shape provide fast, uniform blending without segregation.

Viscosity Control—Various degrees of viscosity up to a paste or semi-solid can be achieved by adding relatively small quantities of Micro-Cel.

Anti-caking Agent—Micro-Cel's high absorption and fine particle size of less than 0.1 micron effectively control caking of deliquescent products and insure flowability even after prolonged storage.

Bulking Agent—A small percentage of Micro-Cel materially increases the bulk of dry powders—allows control of package density.

Pigment Extender—Micro-Cel's surface characteristics, fine particle size and large specific surface, combined with inertness, indicate its value as a pigment extender.

Suspension Agent—Micro-Cel's different combination of properties provides aid in suspension of heavier solids.

Flatting Agent—Micro-Cel's high absorption, fineness and particle shape indicate its value as a flatting agent.

Reinforcing Pigment—The combination of fine particle size, particle shape, and wetting characteristics suggests the value of Micro-Cel as a reinforcing pigment.

Some Proven Uses

Micro-Cel has already been proven as offering outstanding advantages as an absorbent-grinding aid for high liquid concentrate insecticide wettable powders, as an anti-caking agent in fertilizers, insecticide dusts, cleansers and detergents. Additional uses are being explored in Johns-Manville's Research Center.

Chemical Composition

Developed after years of research and experimentation by Johns-Manville, Micro-Cel is produced by the chemical combination of lime and diatomaceous silica under carefully controlled conditions. As a result, specific grades are available offering a wide range of physical properties.

RANGE OF PHYSICAL PROPERTIES

Color	white or off-white
*Absorption, % by weight	
Water	300-600
Oil	275-500
Bulk density, lb./cu. ft.	5-15
Ultimate particle size, micron	.02 to .07
pH	8.0-10.0
Moisture (free), wt., %	5-8
Refractive index	1.52-1.55
Available surface area, sq.m./gm.	95-175

*Will absorb 1 to 2½ times its weight in liquid and remain a free-flowing powder.

Samples Now Available

Micro-Cel is now available for laboratory and production evaluation. Write to Johns-Manville for further data on your specific problems. An engineer from J-M's Celite division will be glad to work with you in adapting Micro-Cel to your own particular requirements. Mail coupon today.

Johns-Manville, Box 60, New York 16, N. Y. CE-2
In Canada: Port Credit, Ontario

☐ Please send additional data and samples of Micro-Cel. I am interested in formulating the following products.

_____

☐ Please have local representative contact me

Name_____

Position_____

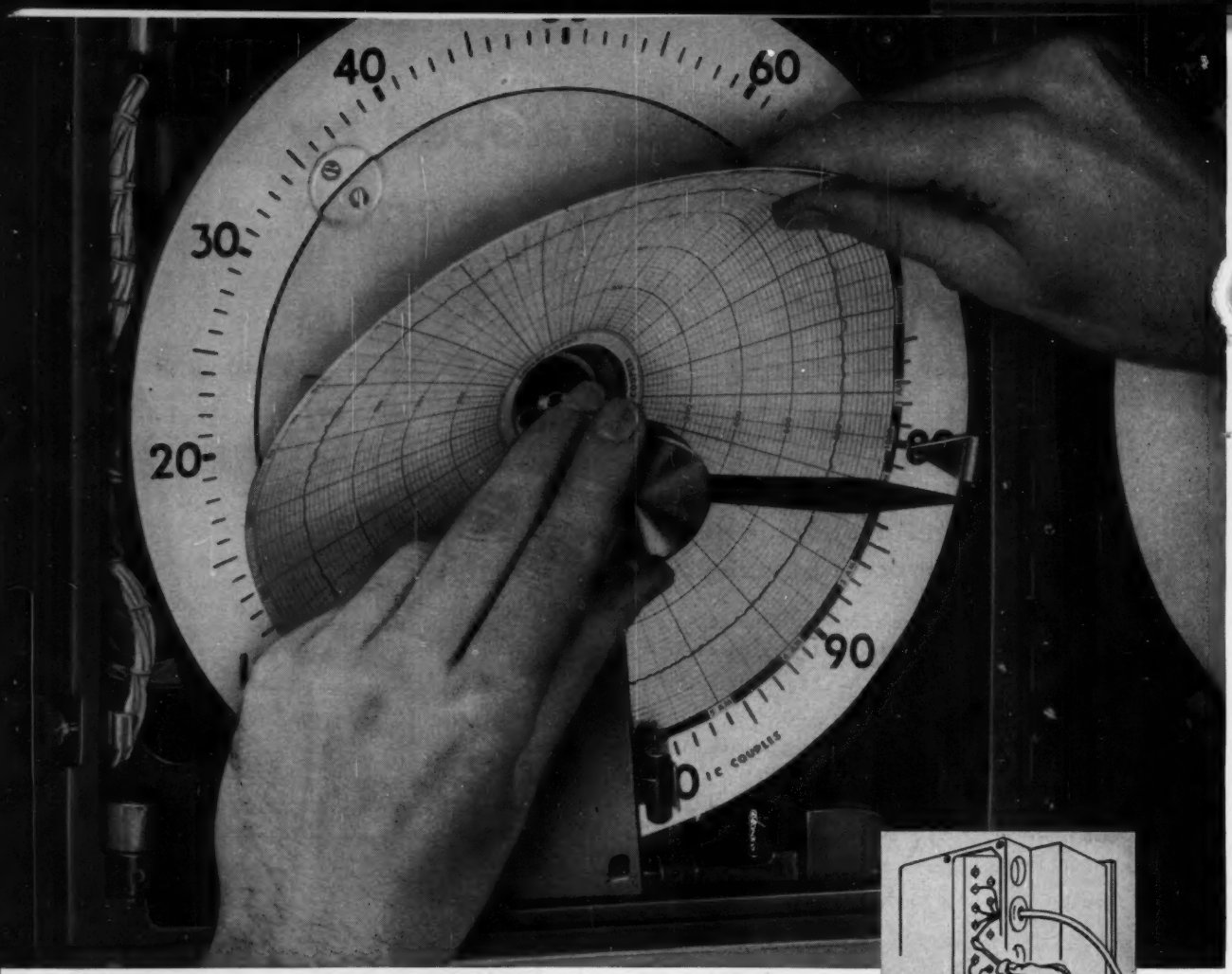
Company_____

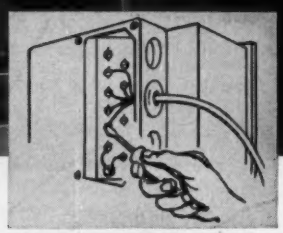
Address_____

City_____ Zone____ State_____

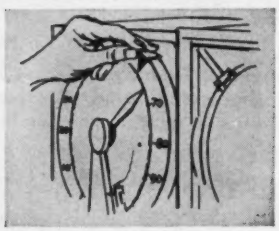
-CEL **SYNTHETIC CALCIUM SILICATE**

A PRODUCT OF THE CELITE DIVISION





To put in operation, simply connect leads to back of case . . .

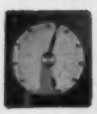


. . . set control point setter
. . . turn on power switch.

A new concept in . . .

operating ease

WITH SPEEDOMAX® H



Although this round chart Speedomax H is small in size, you can set the control point or read it from a distance almost as easily as "big" instruments. For the easy-to-see control and indicating pointers travel around a large 23-inch scale. Chart changes take less than a minute!

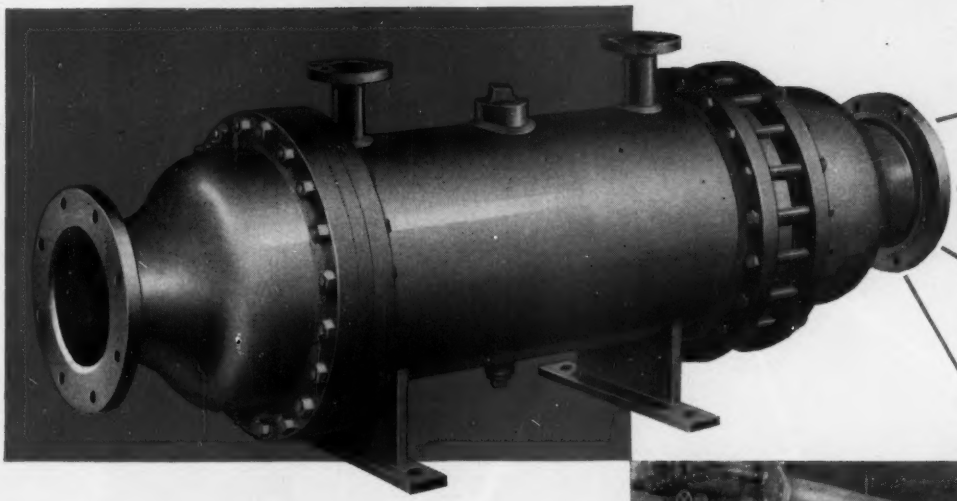
All wiring connections are made to an external terminal board, at rear of the case. If you move the instrument from job to job, range changes can be made on the spot. A screw driver is the only tool you need.

Whether you're using a simple indicator or a 3-action controller, all components are in one compact unit. Relays, amplifiers, etc., have plug-in connections.

In short here's a complete line of null-balance potentiometers available for a broad-range of temperature measurements including many now being made with non-potentiometer instruments.

To see the features of this new line, get our pictorial fold-out. Phone your nearest L&N office or write us at 4916 Stenton Ave., Phila. 44, Pa. and ask for D i e - O u t ND46(1).

LEEDS & NORTHRUP
instruments automatic controls • furnaces



efficient design

special features

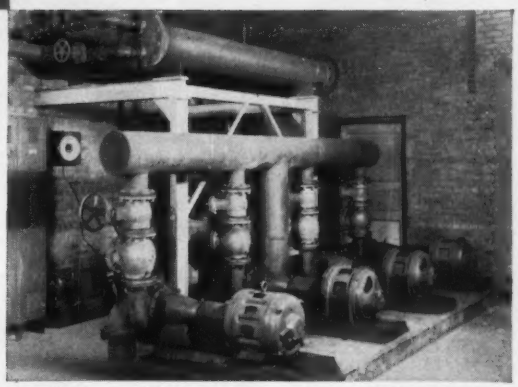
precision workmanship

correct selection and handling of materials

Why **B & G**

Heat Exchangers

give the service you expect



Installation of B&G Heat Exchangers and Centrifugal Pumps.

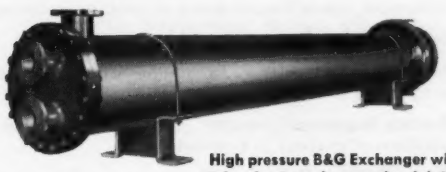
Whether you need an off-the-shelf or a custom-built unit, B&G offers quality and performance perfected in a quarter century of manufacturing heat exchange equipment.

Starting with proper selection and handling of materials, B&G Exchangers are built to designs of proved efficiency and with uncompromising workmanship. Ample material thicknesses in every detail and high tensile strength bolting are assurance of strength and long operating life. Full tube bundles and close tolerances between shell wall and baffles prevent slippage of fluid and assure maximum heat transfer. Units can be furnished with tubing of copper, steel, several of the stainless steels and other non-ferrous alloys.

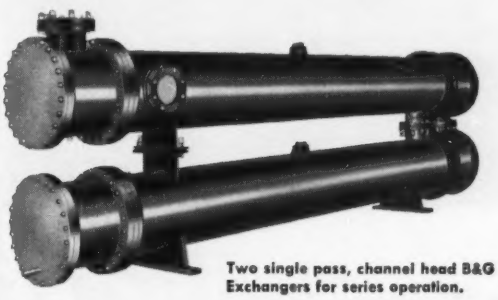
B&G Heat Exchangers are built to ASME Code U-69 requirements and can be certified by Hartford Steam Boiler and Inspection Service.

The B&G engineering staff is always available for consultation on your heat exchange problems. Send for catalog showing application range of B&G Heat Exchangers.

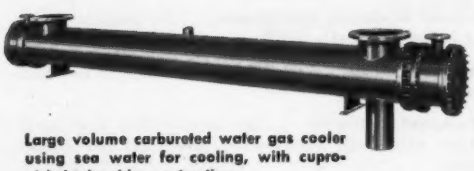
STANDARD DESIGNS OR ENGINEERED TO YOUR REQUIREMENTS



High pressure B&G Exchanger with fixed tube sheets and expansion joint design.

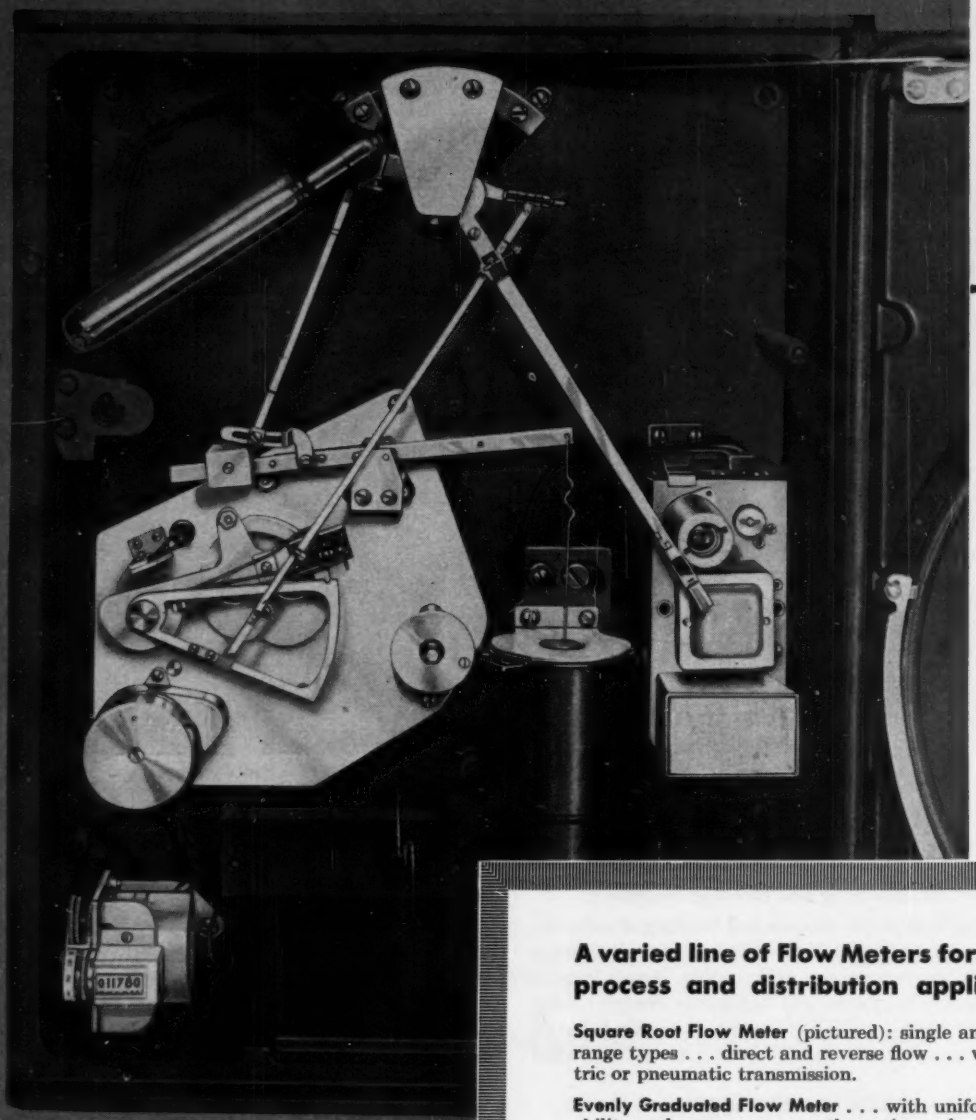


Two single pass, channel head B&G Exchangers for series operation.



Large volume carbureted water gas cooler using sea water for cooling, with cupro-nickel tube-side construction.

BELL & GOSSETT
COMPANY
Dept. EF-14, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, West Toronto



A varied line of Flow Meters for every process and distribution application

Square Root Flow Meter (pictured): single and double range types . . . direct and reverse flow . . . with electric or pneumatic transmission.

Evenly Graduated Flow Meter . . . with uniform readability and accuracy across the entire scale.

***ElectroniK* Flow Meter** . . . indicates, records, controls, integrates, resets control index of another instrument.

Bell Type Flow Meter . . . for low pressure gases.

Ratio Flow Controller . . . regulates secondary flow in proportion to a primary flow.

Process Sequence Controller . . . useful for timing the addition of reagent to a preset cycle.

Parshall Flume Meter . . . for measuring flow in open channels and weirs.

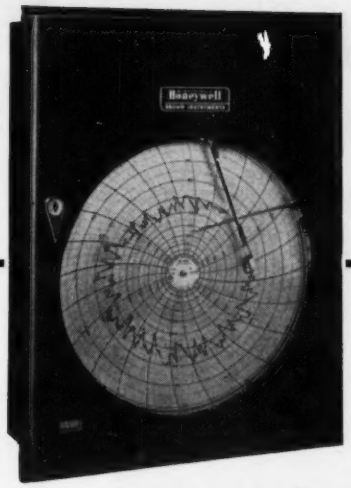
***Tel-O-Set* Miniature Instruments** . . . for graphic panels and other applications where space is at a premium.

Area Flow Meter . . . electric meter body for use with viscous fluids.

Differential Converter . . . the mercuryless flow transmitter with high sensitivity, precision and rangeability.

▲ *Reference Data:*

Write for Catalog 2321, "Flow Meters, Indicating, Recording, Integrating, Controlling."



The Brown

Flow Meter line

was designed for

your process applications

An important reason why Brown flow meters give you better performance is that they were designed specifically for flow recording, integration and control in industrial processes. Far from being step-children of boiler plant instruments, they embody features that fit the needs of modern production technology. Their design has been refined and perfected throughout 28 years of experience in flow instrumentation . . . to assure you of the utmost in precision, versatility and reliability.

For measurement, Brown Flow Meters give you a complete range of meter bodies to work with any fluid at any pressure . . . either electrical or pneumatic transmission . . . and the flexibility of interchangeable range tubes.

For integration, Brown Flow Meters feature accurate, simple electronic flow integration, in a design that places no mechanical load on the measuring mechanism.

For control, Brown Flow Meters, particularly those with square root calibration, offer an unequalled variety of control actions to match the needs of the simplest to the most complex process requirements.

For service, Brown Flow Meters give you basically simple and rugged designs that cut maintenance to the minimum . . . plus the convenience of prompt assistance in start-ups, routine maintenance and emergencies, by Honeywell specialists located near your plant.

Ask your local Honeywell sales engineer to discuss your flow applications. He's well qualified to give competent consultation . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

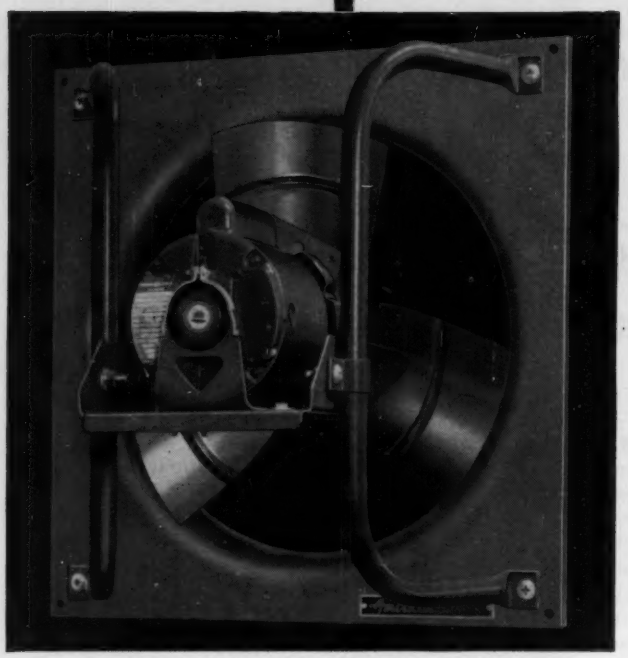
MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

American Blower
Ventura Fans
offer you

top performance and economical ventilation

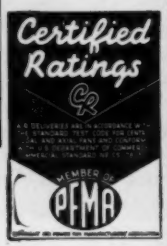


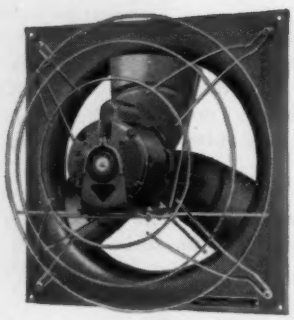
American Blower Model K Ventura Fan

You can count on American Blower Ventura Fans to do the job they are designed for, with high efficiency and a minimum of maintenance. They are built for long life and top performance. All ratings are certified.

American Blower Model K Ventura Fans are ruggedly constructed, heavy-duty propeller fans for tough industrial applications. They offer the power you need . . . when you need it, and will operate against static pressures up to 5/8". Request Bulletin 6514.

American Blower Ventura Fans are attractively designed, quality built, and easy to install . . . *yet competitively priced.* Ventura Fans come in a wide range of sizes and capacities — with constant-speed and two-speed direct drives, totally enclosed motors — to satisfy your exact requirements.





Model G Ventura Fans

Model G, at left, is a sturdily built and attractive fan suitable for light industrial duty and commercial applications. It is especially quiet-operating, making it ideal for offices, stores, and lobbies — or wherever quiet operation is required. Write for your copy of Bulletin 6414, which gives complete performance data.

American Blower products serve industry

Air Conditioning, Heating, Ventilating Equipment
Mechanical Draft Equipment
Industrial Fans and Blowers
Centrifugal Compressors
Gyrol Fluid Drives
Dust Collectors

Division of American-Standard

AMERICAN 75th ANNIVERSARY YEAR BLOWER

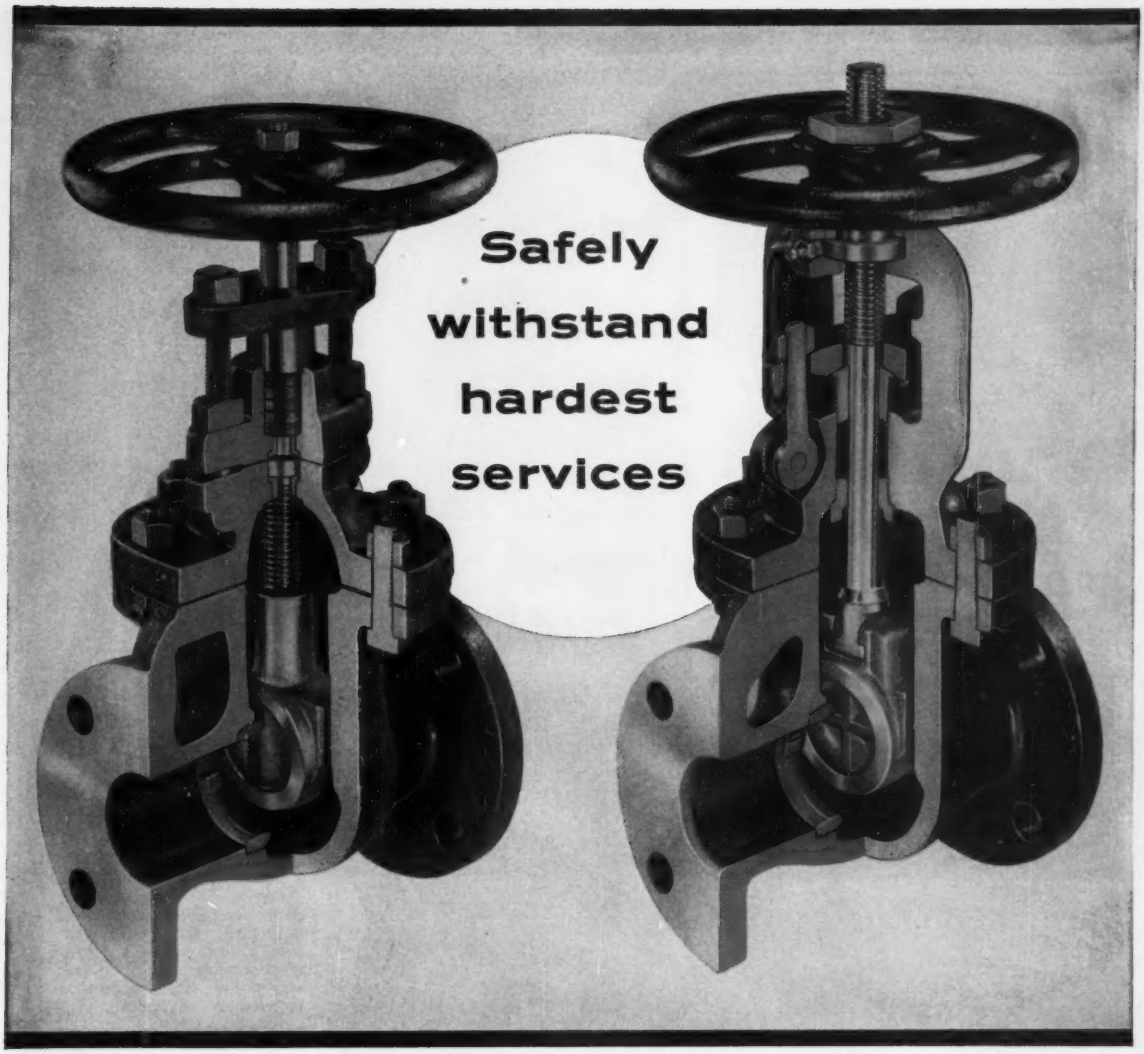


Fig. 1138 (left) non-rising stem, Fig. 1140 (right) OS&Y... two of 29 OIC iron valves with steel valve features. Metals used for trim and pressure parts in this line include: bronze, manganese bronze, nickel-plated steel, higher strength iron, nickel-alloyed iron, Monel, 18-8 stainless, 11-½-13 chrome.

Reduce valve wear. Choose from 29 OIC iron valve numbers with 9 different trim and body metal variations. Depend on them for general use and process industry services handling alkaline liquors, creosote, sour crude, sulphuric acid and caustics.

Working parts design assures positive seating . . . long life

Seat rings are end seated, reducing the probability of loosening in service and affording streamlined flow from port to port. Body wedge guides and a flexible T-head stem-wedge connection combine to assure accurate wedge seating for tight shutoff.

Extra strength adds safety to pressure parts

High-strength iron castings assure pressure parts made to a minimum tensile strength of 31,000 psi. The body and bonnet, elliptical in shape, resist internal pressure with least possible distortion. Body-bonnet bolting provides uniform gasket loading and, consequently, a pressure-tight seal throughout the pressure range of the valves. Tie ribs, cast between the pipeline flange and the body bonnet flange, prevent distortion from excessive pipeline stresses.

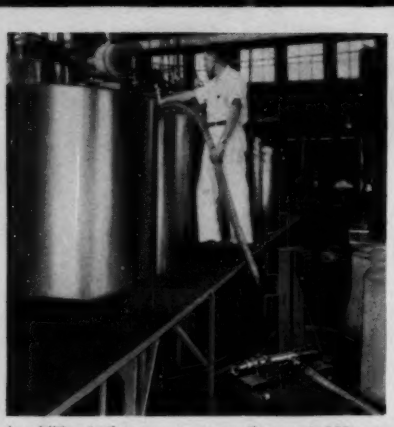
This line's many added features, trim variations, dimensions and end openings are completely described in the new OIC specification folder, Form No. 1005. Write for it.

Order valves from your OIC Distributor.

OIC
FOUNDED 1883

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

VALVES | **FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES**



In addition to the many permanently mounted Moyno pump installations, Realemon has two Moyno pumps mounted on wheels which can be moved to any of the 24 blending tanks. This provides a quick and economical way of blending the juices. The Moyno is self-priming; won't cavitate or vapor-lock. It has no valves to stick, no pistons to gum up. It's trouble-free and built for tough service.

The Moyno pump has had an outstanding performance record for more than 8 years at Realemon-Puritan Company, Chicago, Ill., makers of the famous Realemon beverages. Fruit juice concentrates must be pumped and filtered to blending tanks . . . a task only Moyno pumps can perform to Realemon's satisfaction.

Moyno® Pump exclusive choice of Realemon engineers for pumping juice concentrates

In the preparation of many of the famous Realemon products, concentrated fruit juices often must be pumped and filtered to blending tanks.

Pumps formerly used to handle this exacting process wore out completely in a few months because of their inability to stand up under the high acids in citrus juice concentrates.

Realemon then changed to the Moyno pump. Its unique rotor and stator arrangement forms sealed progressing cavities that move the material and provide positive displacement. For this Realemon application, Moynos with chrome-plated rotors and synthetic rubber stators were selected, to assure trouble-free service and long pump life.

Moyno pumps have now been in operation at Realemon for more than eight years, with an outstanding performance record. The only maintenance required is simply to replace the rotor and stator about once a year.

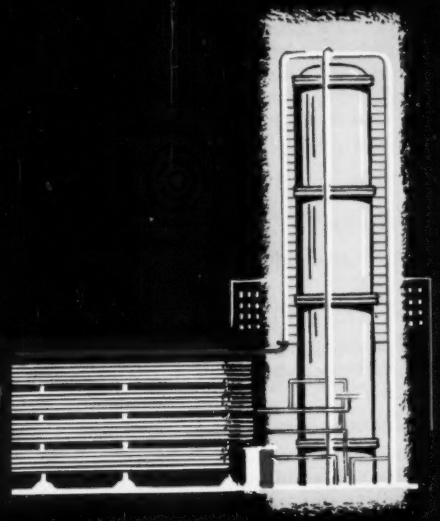
Moynos regularly handle a wide variety of products that other types of pumps can't handle—products such as potato salad, chow mein, fruit, alkalis, pastes, paints, tar —even cement and plaster.

Perhaps the Moyno will solve your pumping problems, too. Write us today for complete information. Ask for a free copy of Bulletin 30-CE.

ROBBINS & MYERS, INC.
MOYNO PUMP DIVISION

Springfield, Ohio
Brantford, Ontario

nitric acid



PRESSURE
PROCESS

THE CHEMICAL AND INDUSTRIAL CORP.
CINCINNATI 26, OHIO

C&I

Specialists in Plants for the Processing of Anhydrous Ammonia
Available throughout the World

can you qualify for

Rocket Engineering?

*careers are being born right now at Rocketdyne**

It may surprise you to know you can do this *with or without specific rocket engine experience!* Engineering experience in heating and ventilating, hydraulics, pumps, turbines, combustion devices, controls and engine instrumentation are just a few of the related fields that could open your future at ROCKETDYNE.

At its new Canoga Park headquarters, ROCKETDYNE is continuing and expanding its pioneering work in the design, development and manufacturing phases of the rocket engine business. And at its test laboratory, ROCKETDYNE has complete research and test operations. ROCKETDYNE thus offers opportunities in the complete range of rocket engine development from preliminary design to field testing.

ROCKETDYNE not only offers the advantages of a constantly growing and expanding company, but also the stability that comes from its broad range and volume of projects... the stability of rocket engine contracts with all branches of the Armed Services and the guided missile industry. Though it is currently emphasizing the production of the most powerful large liquid-propellant rocket engines in the Western World, ROCKETDYNE is also designing, building, and testing many other types and sizes. For the future, it is carrying on research for even more powerful and startling rocket engines.

So this is your big opportunity to build a career that really has a future. A well-paid career that assures prestige, stability, and selectivity of fascinating work. If you feel you can qualify, you owe it to yourself to contact ROCKETDYNE today.

*ROCKETDYNE is North American's rocket engine division. It has just moved into new ultra-modern headquarters in Canoga Park, located in the beautiful West San Fernando Valley of Los Angeles. This area is famous for its fine residential sections, modern shopping-center convenience, varied recreational and entertainment facilities. Any point in the San Fernando Valley is just minutes drive from the beaches, and the weather is pleasant all year 'round. Many engineers are interested in advance schooling offered by UCLA, only ½ hour drive from our laboratory.

THESE POSITIONS NOW OPEN AT ROCKETDYNE:

DESIGN & DEVELOPMENT ENGINEERS

Mechanical, Chemical, Electrical, Standards, Structural and Stress. For rocket engine systems design or development. Turbine, pump, controls and combustion device experience preferred.

DYNAMICS ENGINEERS

To analyze rocket engine control systems utilizing electronic analog and digital computers, B.S., M.E., or B.S.E.E. necessary. Prefer advanced degree. Experience in servomechanisms, systems analysis desired.

COMPUTER APPLICATION ENGINEER

Application of automatic computers to investigate new methods of numerical analysis.

TEST ENGINEERS

Experienced on engine systems, combustion devices, turbines, pumps and engine instrumentation.

EQUIPMENT DESIGN ENGINEERS

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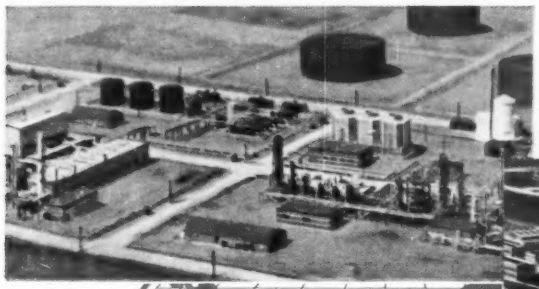
ENGINEERING DRAWING CHECKERS

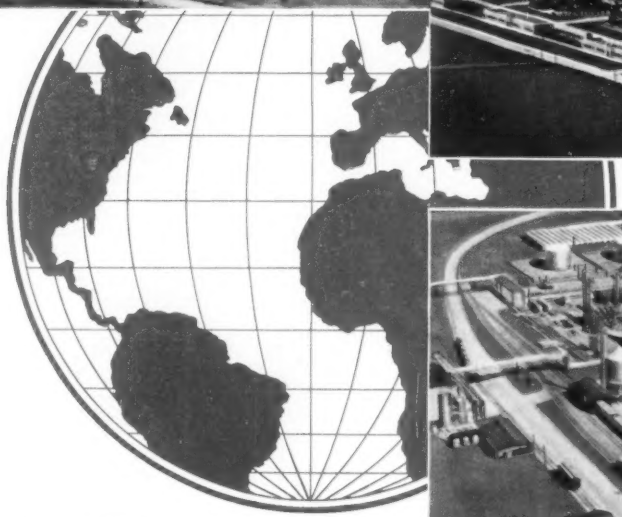
Write Mr. Joe Roberts, Rocketdyne Engineering Personnel, Dept. 596-CE 6633 Canoga Ave., Canoga Park, California.

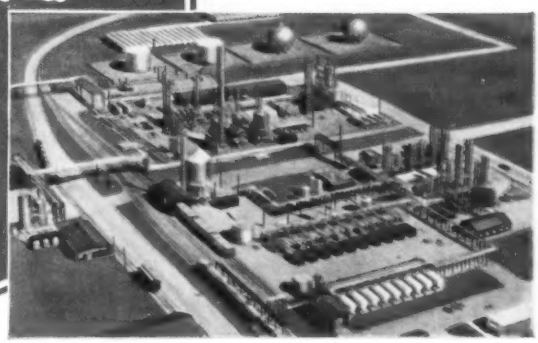
ROCKETDYNE®

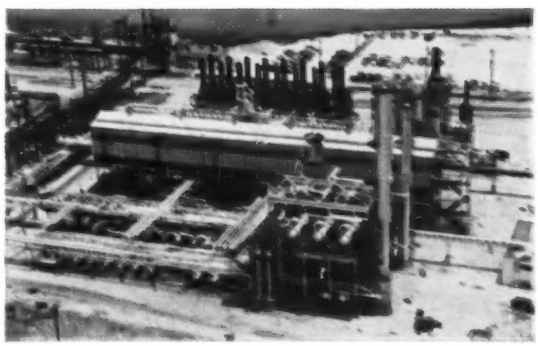
A DIVISION OF NORTH AMERICAN AVIATION, INC.

ETHYLENE—LOCATION and ECONOMICS









Stone & Webster Engineering Corporation has outstanding qualifications for appraising the economics of ethylene production for any location in this country or abroad.

To supply the rapidly expanding market economically and efficiently, five ethylene plants are at present being designed by the Corporation for clients located in four widely separated areas: the Gulf Coast, the Middle Atlantic States, Great Britain and France.

To the design and construction of these plants the Corporation brings the experience of 20 years in the production of ethylene from many different feedstocks, plus an extensive background in producing petrochemicals derived from ethylene and its by-products.

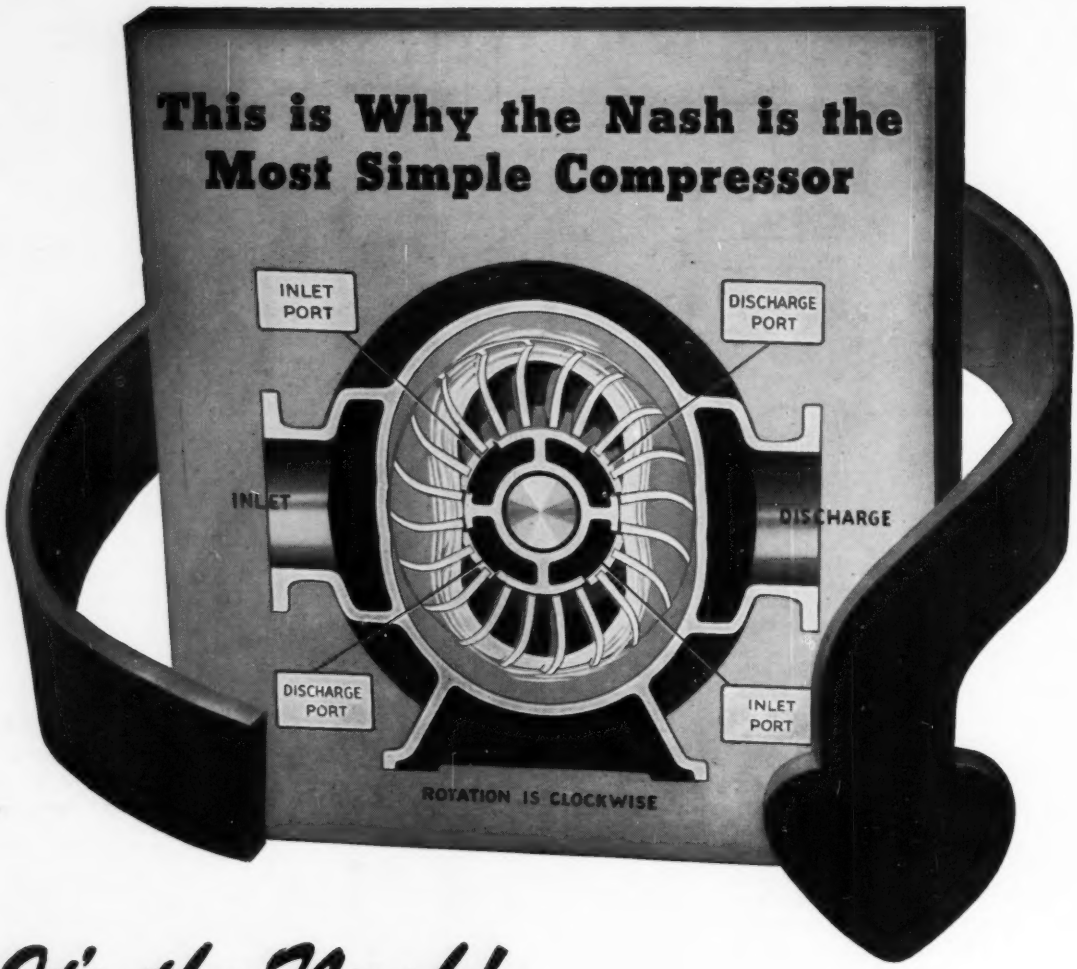
Write or call us for information as to how our experience can be of assistance to you.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

New York Boston Chicago San Francisco Los Angeles Houston Pittsburgh Seattle Toronto

This is Why the Nash is the Most Simple Compressor



It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

313 WILSON, SO. NORWALK, CONN.

BRIEFS for buyers of

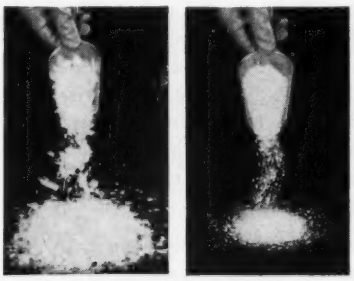
Caustic Soda
Aluminum Chloride
Sulfur Chlorides

He treats our caustic drums rough. A customer in the Pennsylvania oil fields made our salesman wince.

Said he likes our flake caustic soda drums, because they make it easy to distribute caustic in the field. He just shoves the drums off the tailgate of his truck, lets them bounce. He's been doing it for some time without handling losses.

We certainly don't advise this procedure, but it does provide a dramatic testimonial. Six lugs grip the lid of every drum of Hooker flake caustic soda—the best way we've found to keep the caustic dry and pure for your processing or repackaging.

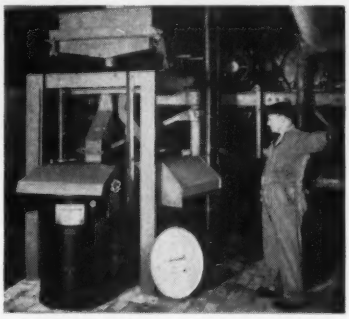
The drum comes to you full of clean, uniform flakes—regular, fine, or crystal—or powdered caustic. The picture below demonstrates how dust-free the flakes are. The coupon offers a helpful booklet on buying caustic soda.



Why we air-condition our aluminum chloride. Even slightly humid air reacts swiftly with aluminum chloride. When it does, the crystals of this sensitive chemical lose their shape, and most of their punch as catalysts.

We avoid such damage to our aluminum chloride by using a special packaging room that is air-conditioned. It gives us complete control over humidity. Regardless of outside weather conditions, we can package aluminum chloride all year 'round.

To you the room means a continuous, dependable supply of full-strength aluminum chloride. And you always get the size you want for your process.



Speaking of size, you have a choice of four from Hooker—extra fine, fine and coarse grinds, and coarse screened. Send the coupon for a data sheet that gives complete specifications on all four or write today on your business letterhead.

How to dry paint in 2 seconds. Many paints, inks, and varnishes take from 24 hours to a week to dry thoroughly.

But pass them through sulfur dichloride vapor, and they dry before your eyes—in from 2 to 20 seconds. This drying process works on paper, wood, cloth, metal, glass, plastics.

Maybe there's a place for superfast drying in your company. If you think so, write us for the name of the process licensor.

Perhaps you're already *using* SCl_2 in a less glamorous but equally useful way. Whatever the need, you can answer it by specifying Hooker sulfur dichloride.

And if it's chlorination you're doing, you might be happy, to know we also make its versatile chemical cousins, sulfur monochloride, sulfuryl chloride, and thionyl chloride.

Sources we've checked indicate we're the only producers of all four of these chlorides. We'll be happy to provide (a) data sheets on any of them, if you'll check the coupon; (b) samples, if you'll just write on your letterhead outlining your needs.

Check items you'd like to receive:

☐ **Caustic Soda Buyer's Guide** • A helpful pocket-size booklet full of information and pictures on forms and sizes; shipping methods and containers; the economics of 50% vs. 73% solutions (with nomograph to help decide which is your best buy); and technical service.

Keep your file up-to-date with technical data sheets on these Hooker chemicals:

☐ Aluminum choride
☐ Caustic soda (standard grade)
☐ Caustic soda (rayon grade)
☐ Sulfur dichloride
☐ Sulfur monochloride
☐ Sulfuryl chloride
☐ Thionyl chloride

Clip and mail with your name, title, and address.

HOOKER CHEMICALS

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

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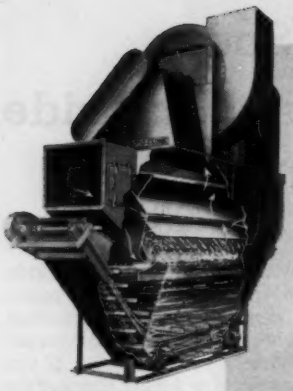
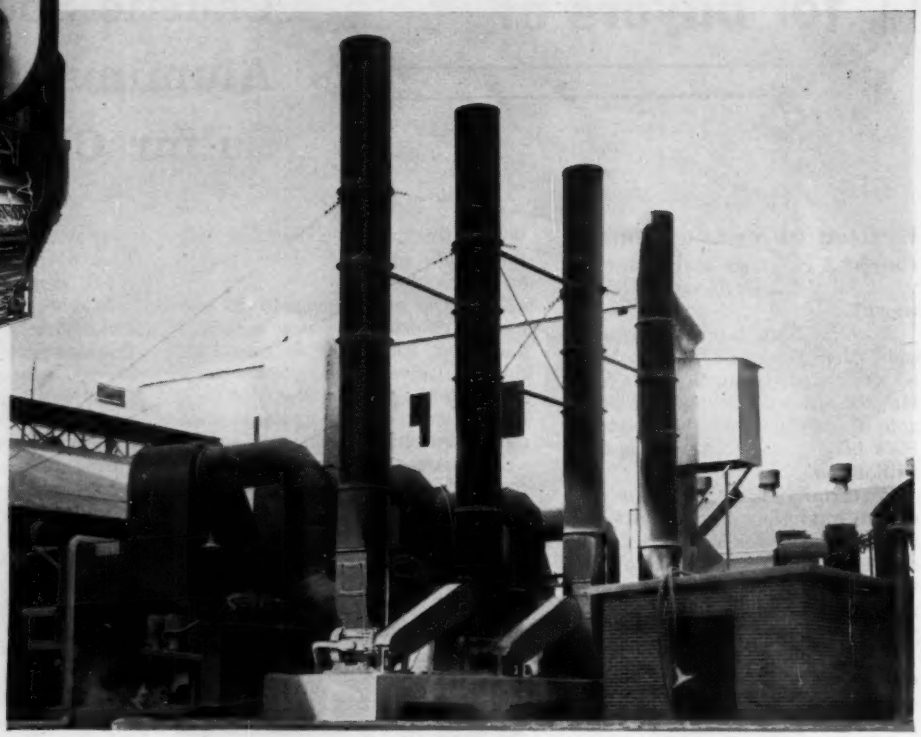
NIAGARA FALLS • TACOMA • MONTAGUE, MICH. • NEW YORK • CHICAGO • LOS ANGELES

S-2107

ROTO-CLONES Collect 5 Tons of Goodwill, Daily!



Type N ROTO-CLONE, Arrangement C—cutaway shows both distinctive water curtain and hopper equipped with automatic sludge ejector.



These four lime kiln stacks are served by four Type N ROTO-CLONES. Results? Note the cleanliness of the stack effluent.

LIME KILN STACK GAS NUISANCE SOLVED THROUGH AAF DUST CONTROL

Every day 5 tons of dust went up these four lime kiln stacks and came down on the plant and surrounding area! Certainly not a pleasant spot in which to work—definitely not a desirable community in which to live.

Here's how an alert management solved the problem. An AAF Dust Control System, consisting of 4 Type N ROTO-CLONES, was installed. Today, instead of being "airborne," this 5 tons of lime dust winds up as a harmless sludge in a settling tank. Just one more example in the chemical, rock products and mining industries where ROTO-CLONE's high cleaning efficiency eliminated dust nuisance.

The Type N is tailor-made for tough jobs including heavy loads of fine dust at high temperatures. The high cleaning efficiency of this hydro-static precipitator results from the combined action of centrifugal force and a thorough intermixing of water and dust-laden air. It is unaffected by high temperatures, can't clog and collects the dust as a sludge for easy reprocessing or disposal.

Call your local American Air Filter representative for complete product information on the Type N ROTO-CLONE or write for Bulletin No. 277. It costs fewer dollars in the long run to collect dust than complaints.

AAF Dust Control Equipment

Illinois Steam Heating Specialties

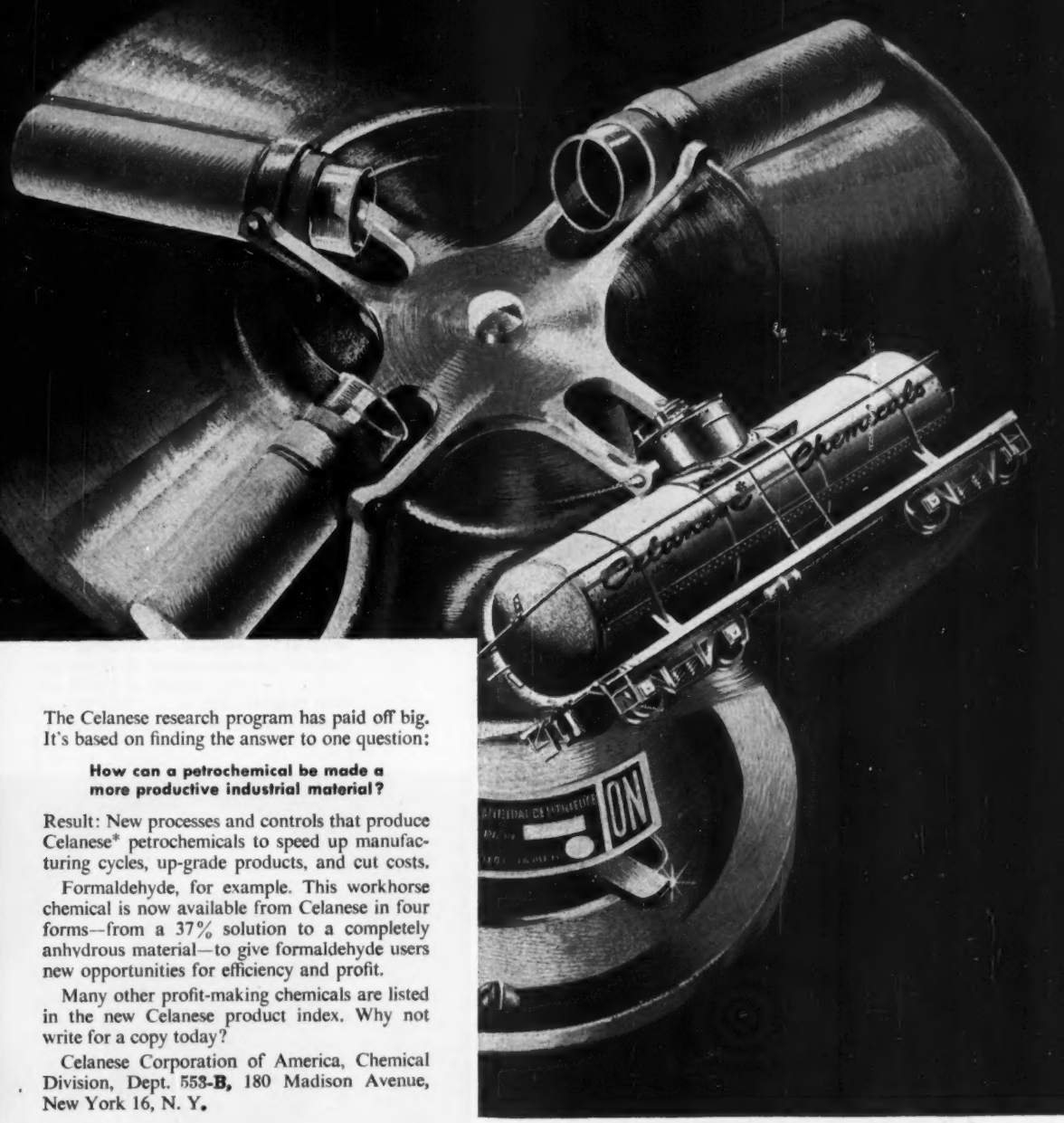
AAF American Air Filter COMPANY, INC.
326 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

BETTER AIR IS OUR BUSINESS

AAF Filters and Precipitators

Herman Nelson Industrial Heaters

Research by the payload



The Celanese research program has paid off big. It's based on finding the answer to one question:

How can a petrochemical be made a more productive industrial material?

Result: New processes and controls that produce Celanese* petrochemicals to speed up manufacturing cycles, up-grade products, and cut costs.

Formaldehyde, for example. This workhorse chemical is now available from Celanese in four forms—from a 37% solution to a completely anhydrous material—to give formaldehyde users new opportunities for efficiency and profit.

Many other profit-making chemicals are listed in the new Celanese product index. Why not write for a copy today?

Celanese Corporation of America, Chemical Division, Dept. 553-**B,** 180 Madison Avenue, New York 16, N. Y.

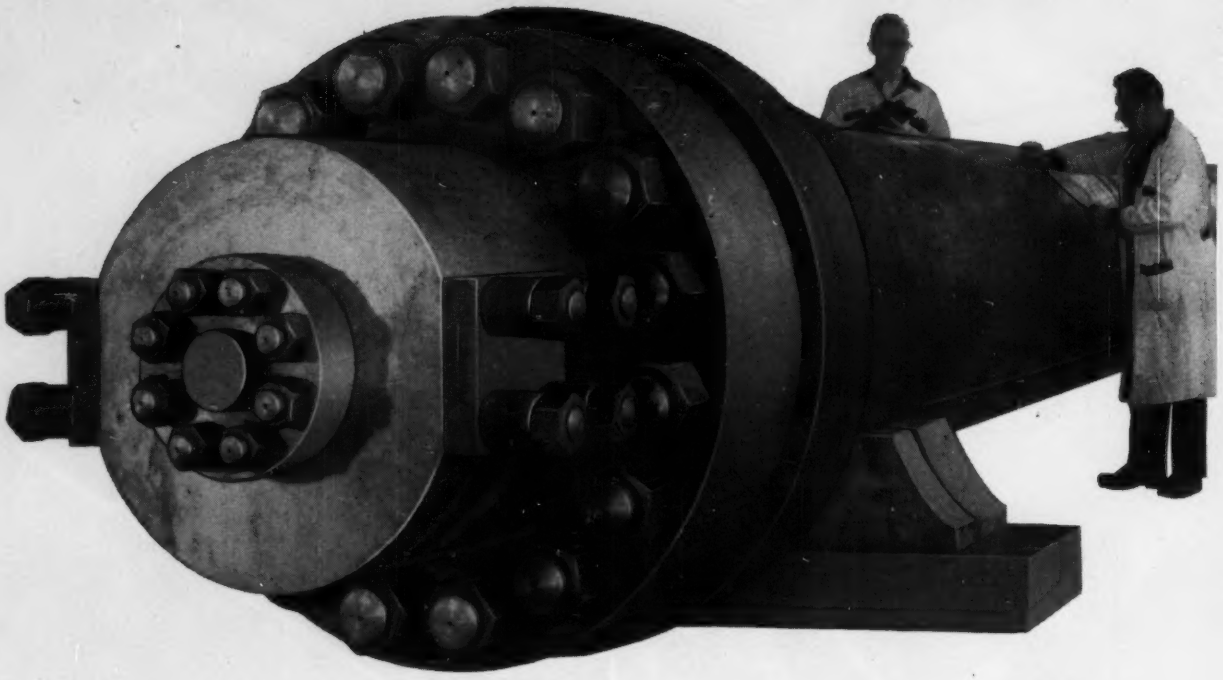
Celanese* CHEMICALS

*Reg. U.S. Pat. Off.

BASIC REASONS FOR IMPROVED PRODUCTS

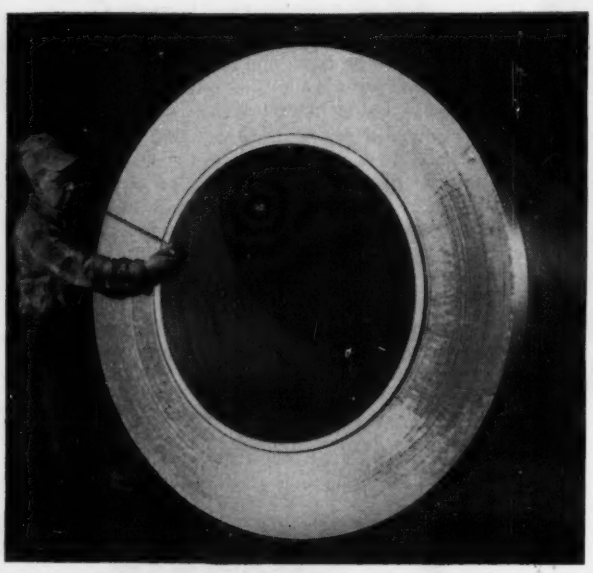
Acids	Glycols	Plasticizers	In textiles, plastics, agriculture, paper, surface coatings, electrical and building materials and equipment, pharmaceuticals.
Alcohols	Hydraulic Fluids	Salts	
Aldehydes	Ketones	Solvents	
Anhydrides	Oxides	Synthetic Oils	
Esters	Polyols	Vinyl Monomers	

8000 pressure vessels ...



MULTI-LAYER AMMONIA CONVERTER
Built for operating pressures of 12,500 psi. . . . test pressures of 18,750 psi.
Wall thickness 9 15/16 in. . . . I. D. 25 3/16 in.
Overall length is 44 ft. Weight 238,000 lbs.

SAFETY — Nearly 8000 MULTI-LAYER vessels in operation — and not a single failure — certainly convincing proof of the safety inherent in this unique A. O. Smith design. To further prove operating safety, we have actually tested many full-scale, high-pressure MULTI-LAYER vessels to destruction. In every case, vessels rupture without shattering or fragmentation.

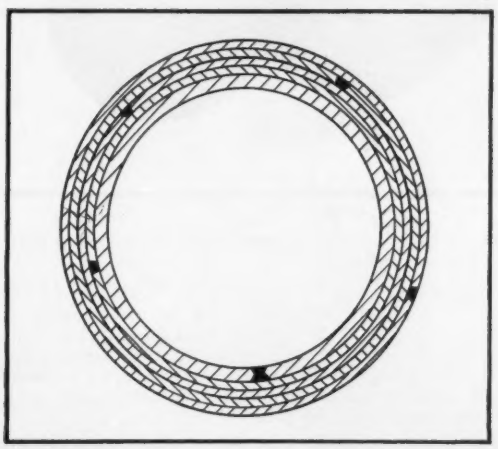


...8000 reasons why you can depend on exclusive MULTI-LAYER CONSTRUCTION

FOR SAFETY

FOR ECONOMY

FOR FLEXIBILITY



ECONOMY — Savings start with fabrication. Instead of using thick plate in a single wall, MULTI-LAYER vessels are built up from concentric layers of relatively thin steel plate . . . progressively wrapped, tightened and welded together around an inner, pressure-tight cylinder. No need for costly stress-relieving in field assemblies. And for corrosive operations, only the inner shell requires special alloys.

FLEXIBILITY —With MULTI-LAYER, there's no limitation of size or weight for your vessel design. You can design for higher pressures, too. Walls can be made stronger simply by increasing the strength of the steel used or by adding more layers. Since shell sections can be welded together in the field, vessel length is not limited.

See how A. O. Smith's exclusive MULTI-LAYER construction can provide safety, economy and flexibility in your own operations. Write our nearest office. We'd be happy to provide more detailed information about MULTI-LAYER construction for high-pressure vessels.

Through research A.O. Smith *...a better way*

A.O.Smith
CORPORATION

PROCESS EQUIPMENT DIVISION
Milwaukee 1, Wisconsin

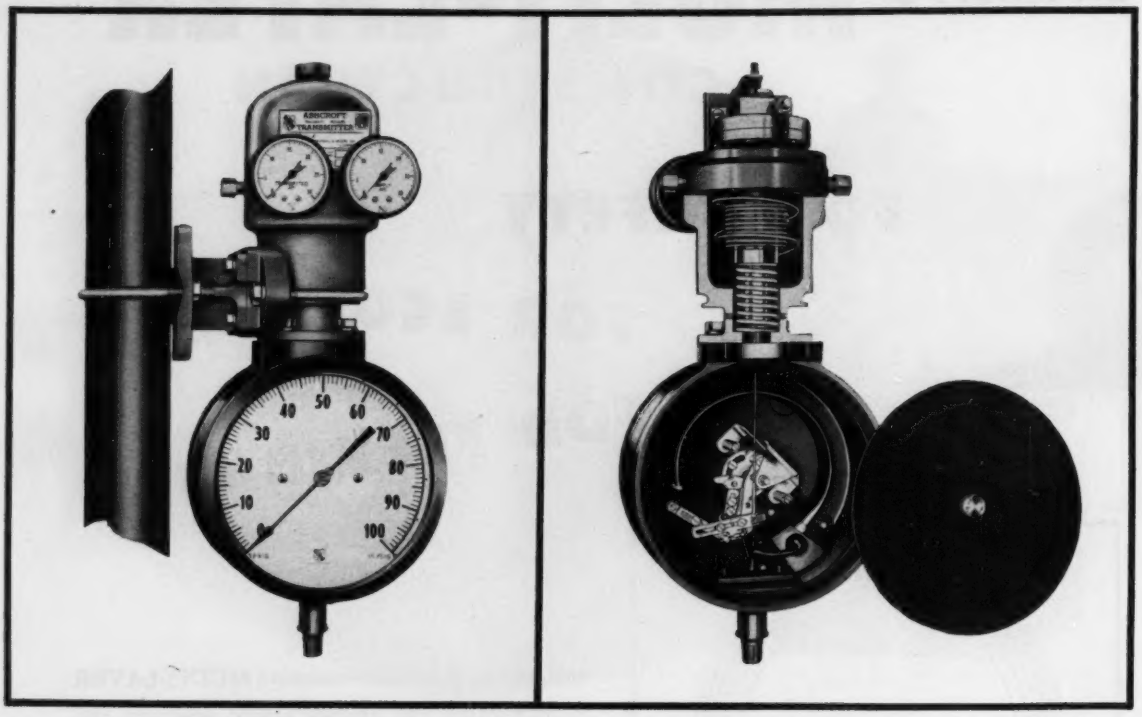
Chicago 4, Illinois • Cleveland 15, Ohio • Dallas 2, Texas • Denver 2, Colorado • Houston 2, Texas • Los Angeles 22, California • Midland 5, Texas • New Orleans 12, Louisiana • New York 17, New York • Pittsburgh 19, Pennsylvania • San Francisco 4, California • Seattle 1, Washington • Tulsa 3, Oklahoma • Washington 6, D. C.

INTERNATIONAL DIVISION: Milwaukee 1, Wisconsin

Licensee in Canada: JOHN INGLIS CO., LTD.

Designed to solve safety and service problems

...THE NEW ASHCROFT PNEUMATIC PRESSURE TRANSMITTER



This new Ashcroft Pneumatic Pressure Transmitter is particularly recommended to processing industries and power stations. It combines speed and accuracy with maximum protection and serviceability.

The new design features the 6½" indicating Ashcroft Maxisafe Duragauge, long known for dependable performance. It has an integrally-cast solid metal wall between dial and pressure sensitive element so that the transmitter can measure pressures up to 100,000 psi with complete safety for personnel and equipment. If misapplication ruptures the Bourdon tube, the Teflon-coated back cover serves as a safety blowout relief.

Another outstanding design advantage is easy access to both gauge and transmitter sections. Simply remove the safety-relief back cover and both the gauge and transmitter can be calibrated. Yet a sealed housing makes the entire assembly weatherproof.

The transmitter operates on low-pressure air. No need for expensive high-pressure lines and fittings. Supply air pressure as low as 18-20 psi for 3 to 15 psi output provides especially advantageous operation where electrical wiring might be a hazard. Inflammable, poisonous or corrosive liquids or gases are confined close to their source, away from the central control point.

The Series 1250 Ashcroft Pneumatic Pressure Transmitter is available with pressure sensing elements in all standard pressure ranges and Bourdon tube materials. Installation of the transmitter is easy. Small diameter tubing may be used, and the pipe, stem, wall or flush mounts are interchangeable in the field. Get complete operational data and construction details. Write for Bulletin 340.

1850 ASHCROFT U.S.A.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR has the broad knowledge and thorough experience essential to satisfy every requirement of your Ashcroft Pneumatic Pressure Transmitter application. You get fast, economical service from his local stocks.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

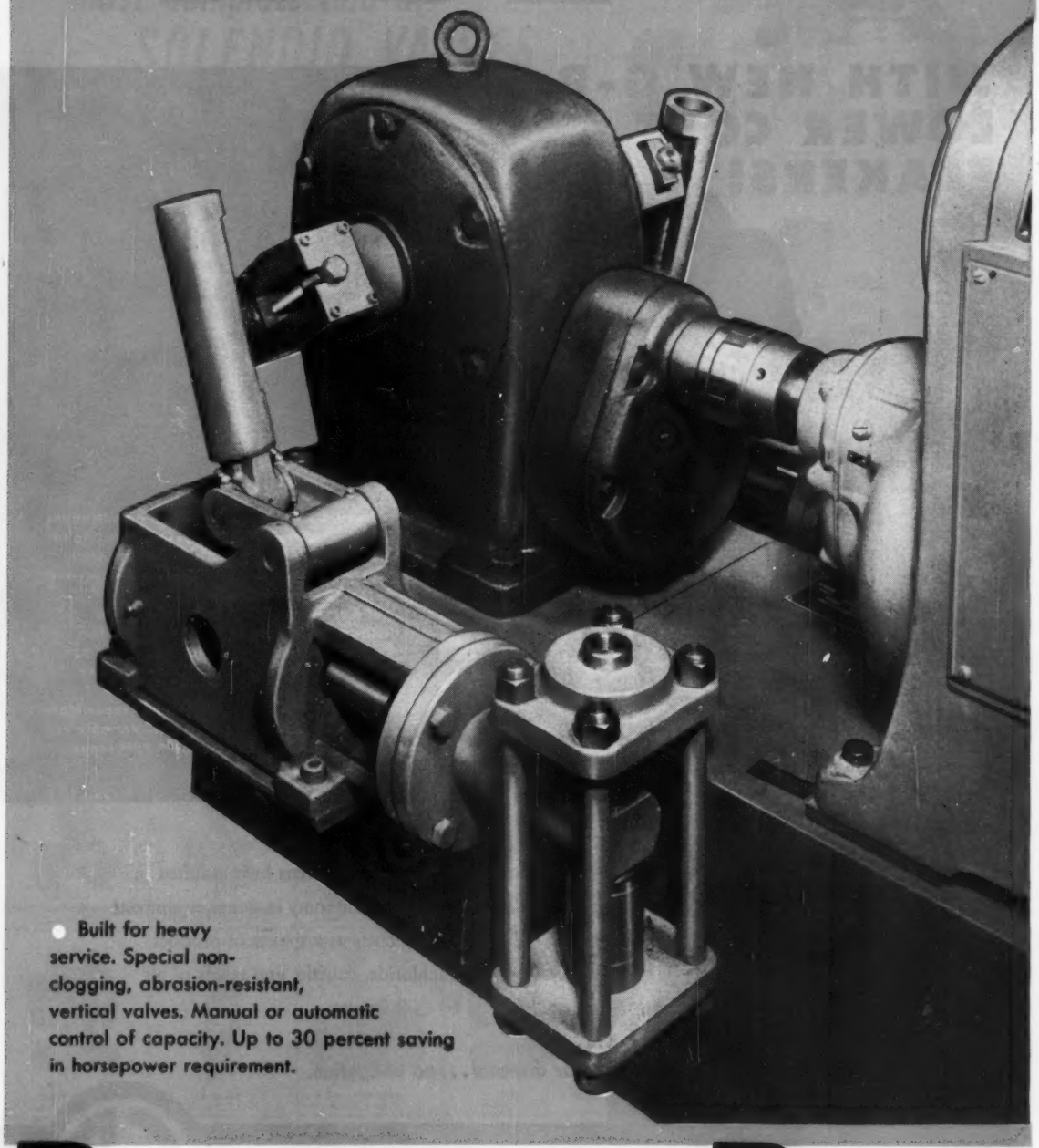
MANNING MAXWELL & MOORE TRADE MARK

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES *Muskegon, Mich.*

chemical pumps...

pressures to 50,000 psi • capacities to 15,000 gph



● Built for heavy service. Special non-clogging, abrasion-resistant, vertical valves. Manual or automatic control of capacity. Up to 30 percent saving in horsepower requirement.

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PHILADELPHIA PUMP & MACHINERY CO. / 1513 Race St., Phila., Pa. / Subsidiary of American Meter Co.

GET DOWN LOW

WITH NEW G-B LOWER COST FLAKERS!

This type G-B Flaker, with slight modifications can be incorporated into your processing for continuous or batch-wise flaking of resins, fatty acids, waxes, insecticides, sulphur, and other organic materials.
4' diameter by 10' face, spray cooled chrome-plated steel drum. Designed for approximately 5,000 pounds capacity per hour. Equipped with pan levelling device to facilitate cleaning. Stainless steel discharge conveyor. Adjustable scraper blade. Simplified level control on pan. Variable speed drive, 3 RPM through 9 RPM range.

We can point to many instances where new, low *first cost* G-B designs have resulted in lower overall product flaking costs, too. This double-barrelled economy in flaker equipment design deserves *your careful re-examination* of your flaking costs as a means of product conversion. Phthalic anhydride, sulphur, benzene hexachloride, caustic, and resins of all types can be efficiently and economically processed by G-B flakers.

Our pilot testing facilities are at your disposal . . . no obligation.

GOSLIN-BIRMINGHAM
MANUFACTURING CO., INC.
BIRMINGHAM • ALABAMA

ASCO

one source for the most complete line of

SOLENOID VALVES

When you discuss solenoid valve requirements with an ASCO Engineer, you are benefiting from the design and development experience of half a century. The ASCO specialist can recommend the *right* valve for your needs because that leadership has resulted in the more than 1300 types of solenoid valves now available:

Two way valves in pipe sizes from ⅛" to 6" – for temperatures to 600° F. – for pressures to 1500 p.s.i.

Three way valves in pipe sizes from ⅛" to 6" – for temperatures to 450° F. – for pressures to 1000 p.s.i.

Four way valves in pipe sizes from ¼" to 1½" – for temperatures to 212° F. – for pressures to 500 p.s.i. – poppet or slide type.

And ASCO can supply you with standard, explosion-proof or water tight enclosures – Class A and Class H coils – a wide range of body materials including cast iron, brass, bronze and stainless steel.

There's *one* source that solves virtually any solenoid valve problem – ASCO. Why not have the ASCO Engineer call – or write for your copy of ASCO Solenoid Valve Catalog No. 24.

MANUAL RESET
Electrically tripped Bulletin 8015
Safety shut-off, no voltage release Bulletin 8025
"Free handle" safety shut-off Bulletin 8020
TWO WAY – FULL PORTED
Low pressure Bulletin 8030
General purpose Bulletin 8210A
Steam Bulletin 8222
TWO WAY – SMALL PORTED
Midget, general purpose Bulletin 8262
Fuel oil and gas Bulletin 8268
Explosion proof Bulletin 8269
THREE WAY
Pilot control of diaphragm or cylinder Bulletin 8300
Explosion proof Bulletin 8302
Midget, general purpose Bulletin 8314
FOUR WAY
Single solenoid Bulletin 8344
Dual solenoid Bulletin 8344
Midget, general purpose Bulletin 8345

CORROSION RESISTANT
Cylinder operated, Saunders body Bulletin 8336
Compact Saunders type Special Bulletin 8336
Three way Special Bulletin 8300
Cylinder operated, many body materials Bulletin 8338
PILOT CONTROLLED
Water and gas Bulletin 8333
Three way Bulletin 8331
Expansible sleeve Bulletin 8335
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SPECIAL PURPOSE
Cylinder operated, sanitary Bulletin 8337
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Automatic Transfer Switches
Electromagnetic Controls
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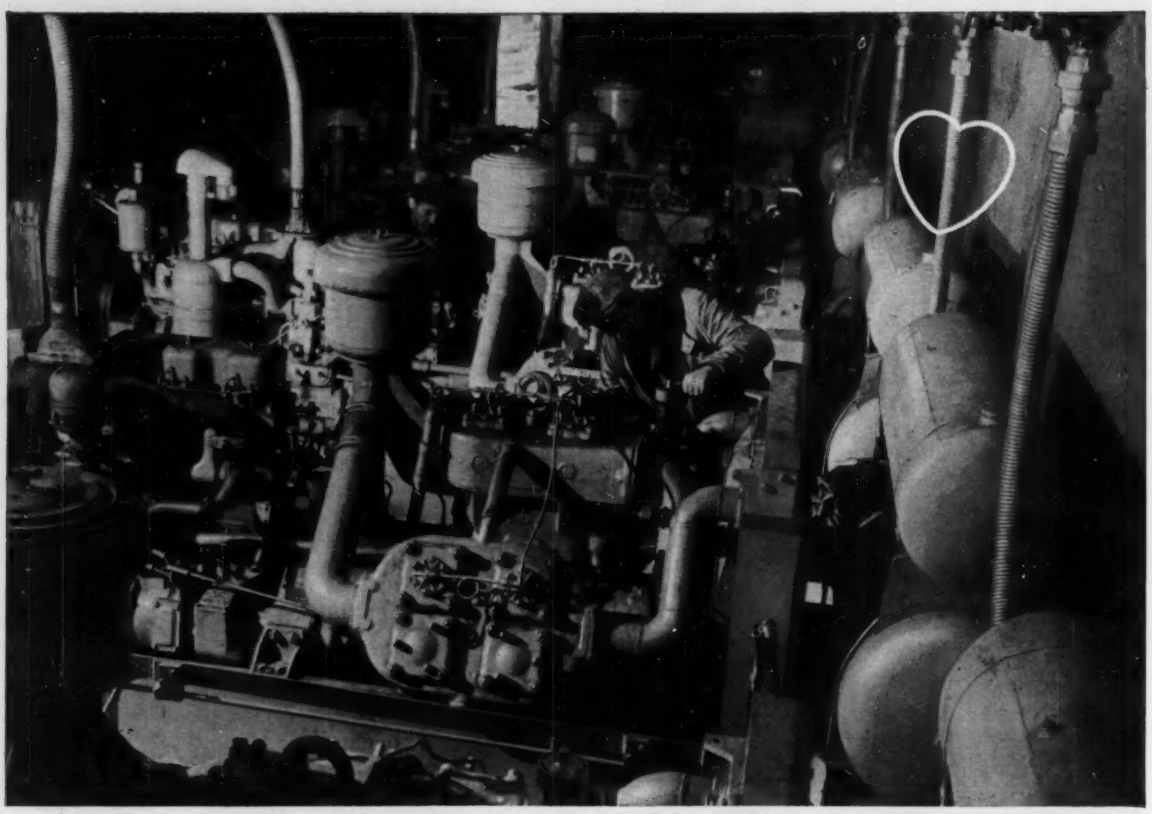


TAKES POUND OUT OF AIR POUNDING

DURABLE Penflex TUBING ABSORBS NOISE . . . VIBRATION . . . PUNISHMENT

"Transports air, but not the vibration" is remark often heard about Penflex tubing installed on air intake and exhaust lines. And for this room where a battery of eleven air compressors are operating, that can mean a lot of air in motion . . . and plenty of noise eliminated.

There's no question of air leakage, either. Penflex four-wall interlocked flexible tubing is as tight as the proverbial drum. In durability it has the edge over rigid pipe, for the many interlocked sections have a "give" which soaks up the minute but ceaseless vibration which causes ordinary pipe to fracture . . . in addition to absorbing an ear-splitting din.

Penflex tubing can be built up to pressures . . . or down to size—as small as ⅛" I. D., or as large as 24" I. D. Different types, weights and materials are available. Selection of the tubing best suited for the job is a specialized segment of engineering . . . "Flexineering," we call it.

Penflex engineers will help you to "Flexineer"—one job or an entire plant—for steam or Diesel power generators, compressor stations, various oil, water and steam circulating lines, bulk unloading, or a host of other jobs.

You'll find our booklet "Flexineering" helpful, too. Write for a copy today.

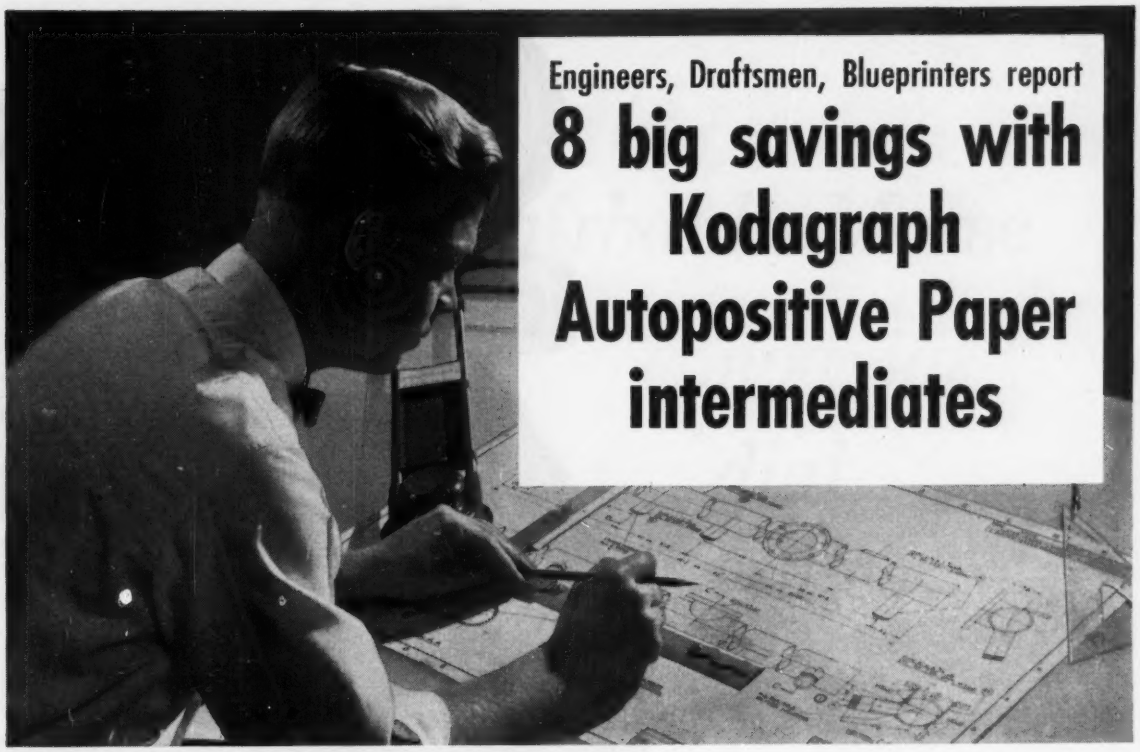
Pennsylvania Flexible Metallic Tubing Company, Inc., 7234 Powers Lane, Philadelphia 42, Penna. • *Branch Sales Offices:* Boston New York • Chicago • Houston • Cleveland and Distributors in Principal Cities

flexineering by

PENFLEX

HEART OF INDUSTRY'S LIFELINES

FLEXIBLE TUBING, AUTOMATIC BARREL FILLERS, PNEUMATIC RIVET PASSERS, ACCESSORIES AND FITTINGS



Engineers, Draftsmen, Blueprinters report

8 big savings with Kodagraph Autopositive Paper intermediates

Revolutionary Kodagraph Autopositive Paper, which produces positive photographic intermediates *without a negative step or dark room handling,* brings these savings to drafting rooms large and small.

1. Protects original drawings. Low-cost Autopositive Paper intermediates are used instead of valuable originals in printmaking, reference, mailing, and making revisions.

2. Reclaims drawings which are old, worn, or soiled. Reproducing them on Autopositive Paper cleans up backgrounds, strengthens line detail . . . eliminates redrafting.

3. Improves legibility of prints. Blueprints or direct-process prints made from Autopositive Paper intermediates are consistently easier to read than prints made from original drawings.

4. Reproduces "unprintable" originals. When extra copies are needed of blueprints, drawings on opaque stock, two-sided originals, and other "unprintables," just reproduce them on Autopositive Paper *and you have your printmaking masters.*

5. Speeds revisions of drawings. A popular short cut is to cut out or eradicate detail on an Autopositive Paper intermediate . . . and then add the new detail to this print or one made from it.

6. Eliminates redrafting standard component designs. From a file of standard component designs made on Kodagraph Autopositive Film, select the ones needed and attach to drawing form with translucent tape. Then reproduce on Autopositive Paper, add new detail and the job is done.

7. Simplifies print distribution. Instead of shipping bundles of production prints, send Autopositive Paper intermediates. Mailing costs are saved. Required number of prints can be made at other end. No overstocking this way . . . or running short of prints.

8. Provides photo-lasting copies. Autopositive Paper intermediates, with dense black photographic lines on a translucent white paper base, will not turn yellow or become brittle in the files; will produce sharp, legible prints whenever needed.

New illustrated booklet gives full story on Kodagraph Autopositive Paper, which you, or your local blueprinter, can process readily with existing printmaking equipment and standard photographic processing.

Kodagraph Reproduction Materials

MAIL COUPON FOR FREE BOOKLET

EASTMAN KODAK COMPANY
Graphic Reproduction Division, Rochester 4, N. Y.

Gentlemen: Please send me a free copy of your new booklet on Kodagraph Reproduction Materials.

105

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Position_____

Company_____

Street_____

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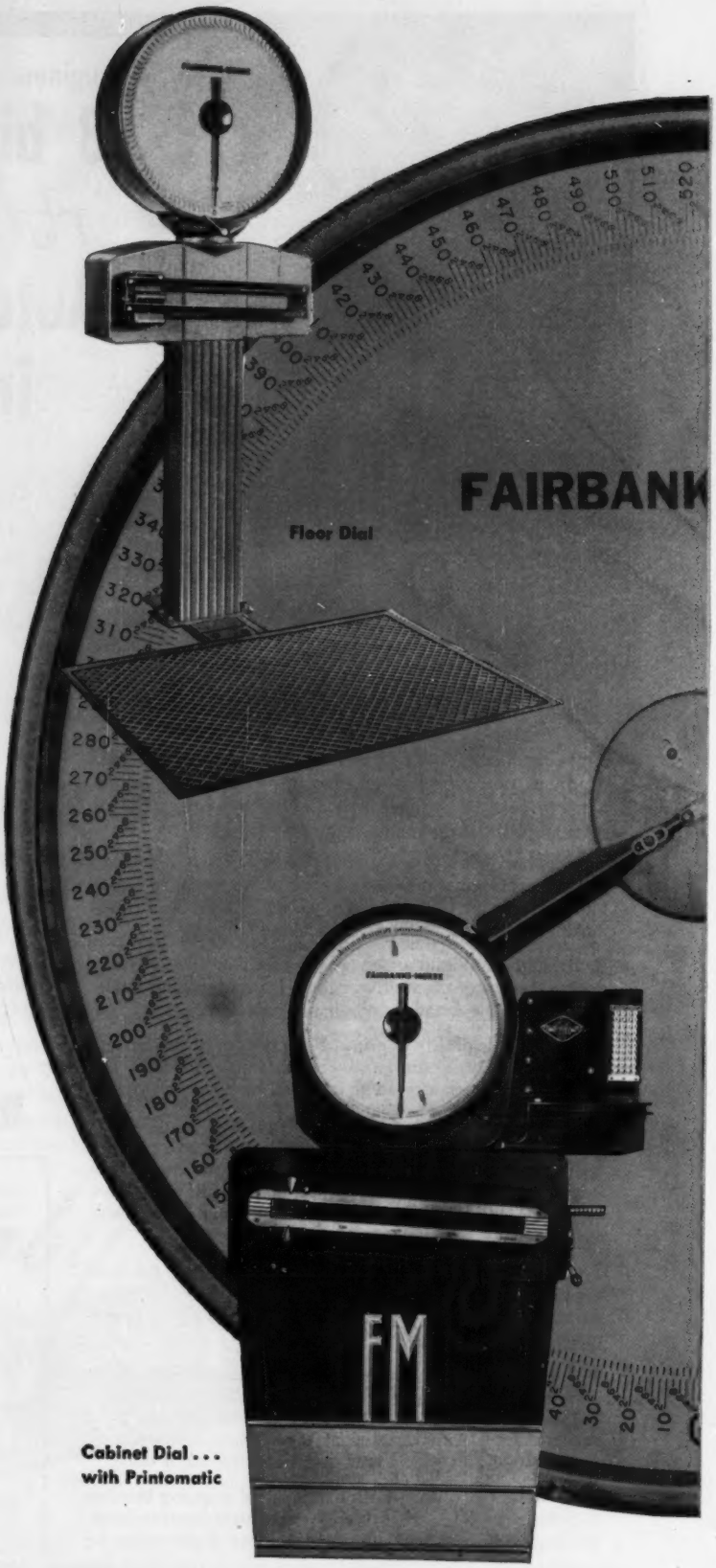
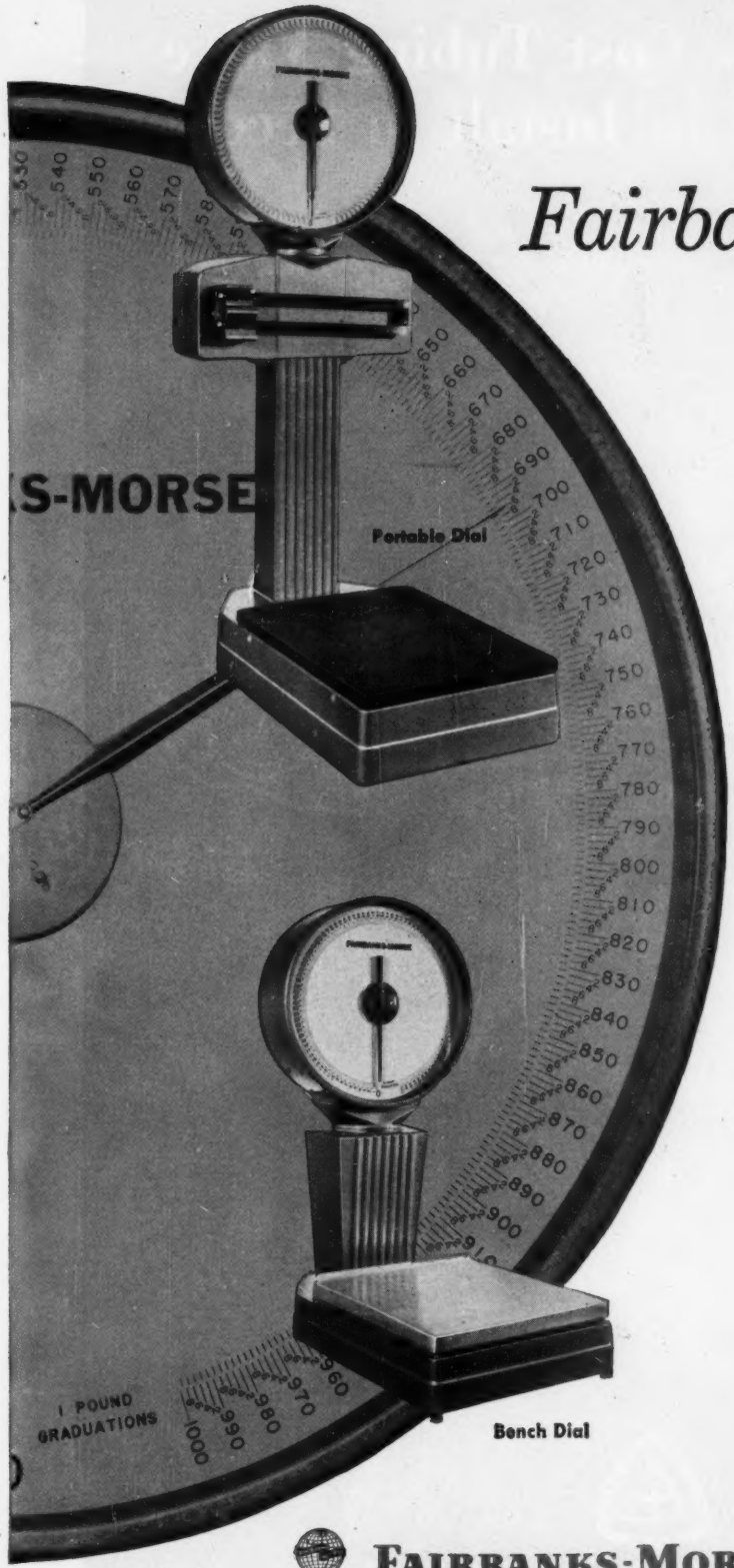
Zone_____ State_____

Kodak

announcing:



Cabinet Dial . . .
with Printomatic



Fairbanks-Morse

floaxial dial scales

EASY TO READ...

EASY TO USE...

LASTINGLY ACCURATE

Everything you've ever wanted in a dial scale, you'll find in the completely new . . . completely different Fairbanks-Morse line!

Fairbanks-Morse engineers designed the new line with your needs in mind . . . based on exhaustive field reports. They're streamlined . . . easy to read . . . easy to use . . . rugged to resist shock loads and rough handling . . . easy to service and maintain. And, above all, they have the new, patented *Floaxial* dial mechanism that assures enduring accuracy. There are no knife edges or pinpoint pivots to wear and affect long-life accurate weighing.

Dial chart and indicator are designed for easiest reading—ever! There's nothing to distract the eye . . . you get faster, easier weight indication . . . less chance for reading errors. Dial head swivels a full 360 degrees for easy reading at any angle!

For the complete, time-saving, cost-saving story on the new Fairbanks-Morse Dial line, see your Fairbanks-Morse Weighing Expert or write direct, on your letterhead, for new, colorful, descriptive bulletin on the type of Floaxial dial you want. Address Fairbanks, Morse & Co., Dept. SJ-1, 600 S. Michigan Ave., Chicago 5, Ill.

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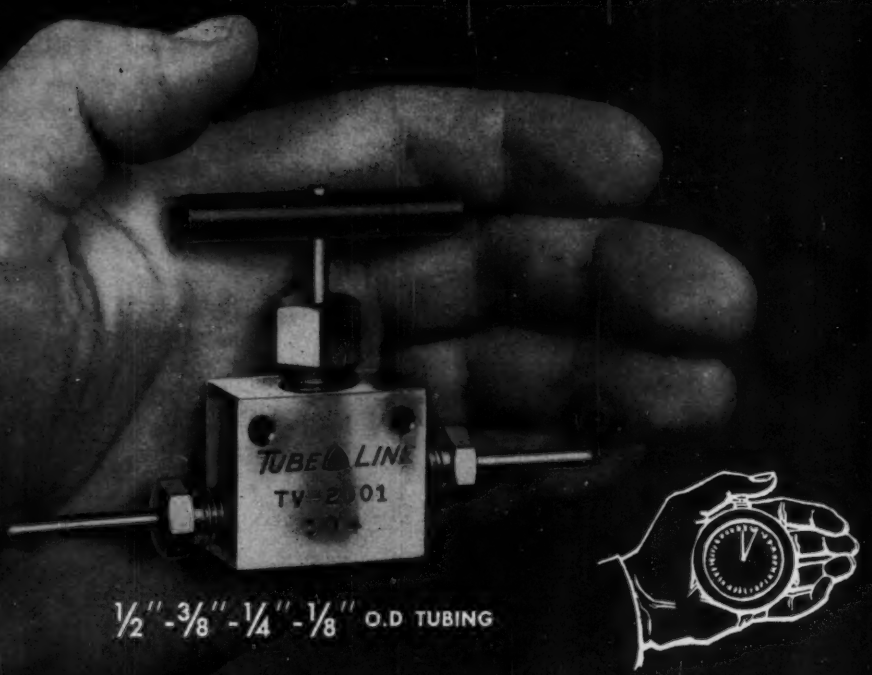
a name worth remembering when you want the best

SCALES • PUMPS • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • RAIL CARS • HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

NEW... Low Cost Tubing Valve You Can Install in Seconds



$\frac{1}{2}$"-$\frac{3}{8}$"-$\frac{1}{4}$"-$\frac{1}{8}$" O.D TUBING

TUBE LINE VALVE
- No Pipe Threading
- No Beveling
- Gas Tight Seal
- Up To 4000 P.S.I.

Here is a high quality, low-cost valve for tubing . . . the NEW TUBE LINE Valve. You can cut it into the lines in a jiffy . . . requires no threading, no beveling, no pipe-wrench . . . and every joint is a union. What's more, this new valve costs less initially and works better than any conventional screw-end valve.

Here's how the TUBE LINE Valve works: Cut tubing to required length, slip adapter nut and sleeve on, insert into valve and tighten joint . . . a gas-tight seal up to 4000 p.s.i. in a matter of seconds.

The TUBE LINE Tubing Valve body is made of 304 stainless steel, the stem is 410 stainless steel heat treated and ground, with rolled threads. Gland nut is 416 stainless steel, the stem thread is in the gland nut and outside the pressure zone.

Full details on TUBE LINE Tubing Valves are available in Bulletin 255. Write for it.

TUBE LINE

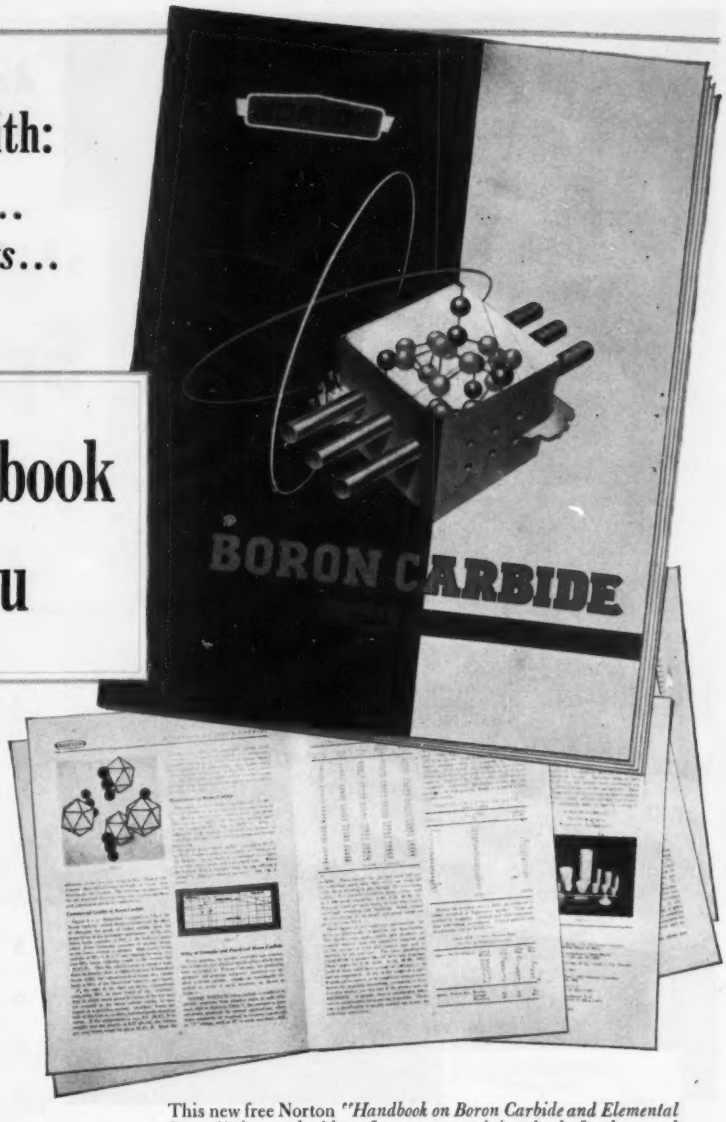
AUTOCLAVE ENGINEERS, INC.

860 EAST 19TH ST. • ERIE, PENNSYLVANIA

If you are concerned with:

Reactor development...
Atomic energy projects...
Nuclear problems...

This new data book will help you



This new free Norton *"Handbook on Boron Carbide and Elemental Boron"*, is a valuable reference, containing both fundamental data and practical information. Printed in colors with many charts and tables it will serve as a useful and permanent addition to the reference files of those concerned with atomic energy and related fields.

In nuclear science and engineering the importance of the neutron absorption reaction of the boron isotope B^{10} is well recognized.

Now, for the first time, available data on the development of numerous stable, boron-rich materials have been compiled and coordinated by Norton in one convenient reference book.

This book is the *"Handbook on Boron Carbide and Elemental Boron"* — a compact source of technical information on materials made by Norton for use in the atomic energy field.

A partial list of the table of contents includes: *Boron for neutron absorption... Technical grade boron... Properties of boron... Commercial grades of boron carbide... Radiation damage to boron carbide... Bonded boron carbide (carbon, silicate, plastic, metal)... Boron nitride... Metal borides.* These and many other subjects are fully described and illustrated with tables, charts and photographs.

A Quarter-Century of Experience

Work in Norton laboratories on boron compounds began some 25 years ago. This included the development of NORBIDE* boron carbide, the hardest material yet produced commercially. Norton facilities for producing NORBIDE wear-resistant articles and abrasive have been expanded to supply boron carbide in numerous forms for atomic energy applications.

Recent Norton development has been aimed at improving the quality, increasing the production and reducing the costs of various boron-rich products. As a result, Norton now produces these materials to highest purity standards, at prices ranging between one-half and one-tenth of former pricing.

Other Norton Electric Furnace Products

of special interest to nuclear engineers include ALUNDUM* fused alumina, CRYSTOLON* silicon carbide, MAGNORITE* magnesium oxide, FUSED ZIRCONIA and various refractory carbides, oxides and nitrides.

Besides being the basic ingredients of the famous Norton Refractory Rx's — refractories *engineered and prescribed* for the widest range of conventional applications — these high-melting materials are finding many new and valuable uses in atomic energy projects.

They are all described in the new Norton handbook. For your free copy, write to NORTON COMPANY, Refractories Division, 501 New Bond St., Worcester 6, Massachusetts.

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REFRACTORIES
Engineered... Rx... Prescribed
Making better products... to make your products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

An entirely new concept in pressure vessel closure

Now Standard on all Sparkler Model MCR Filters

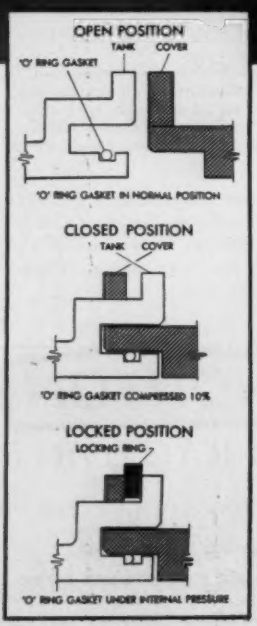
SPARKLER-PASSALAQUA

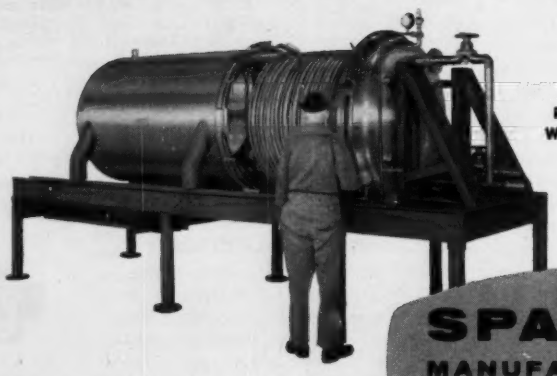
Speed-Lock Cover

A. S. M. E. APPROVED

With these 8 advantageous features

1. Easy to operate—can be opened and closed in seconds by hand, with your eyes shut.
2. O-ring gasket gives self-seal which becomes tighter as internal pressure increases.
3. Visible bow-shaped lugs on third ring lock cover quickly and surely.
4. Locks in both opened and closed positions.
5. All holding devices are engaged at once.
6. Stress divides itself equally among all lugs.
7. Fabricated and forged of high tensile strength steels.
8. A.S.M.E. Approved.





MODEL MCR RETRACTABLE TANK FILTER WITH SPARKLER-PASSALAQUA SPEED-LOCK COVER

SPARKLER MANUFACTURING CO.
MUNDELEIN, ILL.

Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia. Service representatives in principal cities throughout the world.

Filtration engineering and manufacturing exclusively for over 30 years.

This customer saved 46% in freight charges

on these stainless steel plates

THESE STAINLESS sketch plates, produced by G. O. Carlson, Inc., saved the customer 46% in shipping costs. If he had bought rectangular plates and done his own cutting, he would have paid freight on excess material which he could not use.

Then too, cutting and machining facilities were quite limited at the job site. Time and money were saved by having Carlson cut and machine the plates to the accurate tolerances specified.

For your next work involving stainless steel plates, heads and other stainless products, let us show you how—*and how much*—you save by buying from G. O. Carlson, Inc.

Stainless Steels Exclusively

G. O. CARLSON, INC.

Plates • Plate Products • Forgings • Bars • Sheets (No. 1 Finish)

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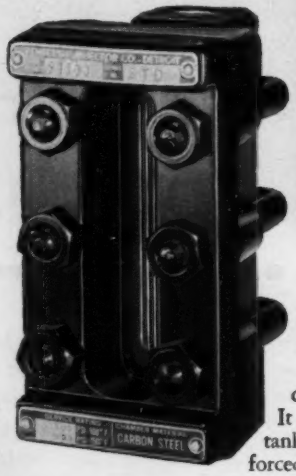
District Sales Offices in Principal Cities

Look For More Penberthy Installations During '56

Clear, Accurate... Easily Installed and Maintained for tanks, containers and flow lines...

Liquid Level GAGES and Gage Valves by PENBERTHY



PENBERTHY GAGES

...with exclusive Raised Face

REFLEX liquid level gages.

TRANSPARENT water and liquid level gages.

TRANSPARENT High Pressure liquid level gages.

Frost-free Gages, Heating Tube and Heating Chamber Gages, Welding Pad Gages, Large Chamber Gages, Inclined Gages and Explosion-proof Illuminators.

PENBERTHY GAGE VALVES

...with exclusive Floating Shank

Tubular and Threaded gage valves • Jacketed Gage Valves • Instrument Valves • Wire glass protectors, plate glass protectors, sheet metal guard protectors.

• The Penberthy line is designed specifically for chemical industry service. They are rugged and reliable . . . engineered with exclusive features to save you time and money.

Savings of 50% and more on installation costs alone are credited to the "floating shank" of Penberthy Gage Valves. It compensates for variations in center-to-center distances of tank tappings or gage assemblies . . . eliminates strains of forced installations.

Cleaning or replacement of gage glass is facilitated by the "Raised Face", standard only on Penberthy Gages. Perfect alignment of frame with glass and gasket is assured also.

Feature for feature, Penberthy offers you the best value for your dollar. Compare the line shown in Catalog 35 with any other. We'll be glad to send you this catalog on request. Also sold through supply stores in most fields.

PENBERTHY INJECTOR COMPANY

Division of the Buffalo-Eclipse Corporation

1242 HOLDEN AVENUE **DETROIT 2, MICHIGAN**

ALCOA Alumina is still one of industry's "best buys"

Despite sharply rising costs, ALCOA's prices remain uniformly low since 1915

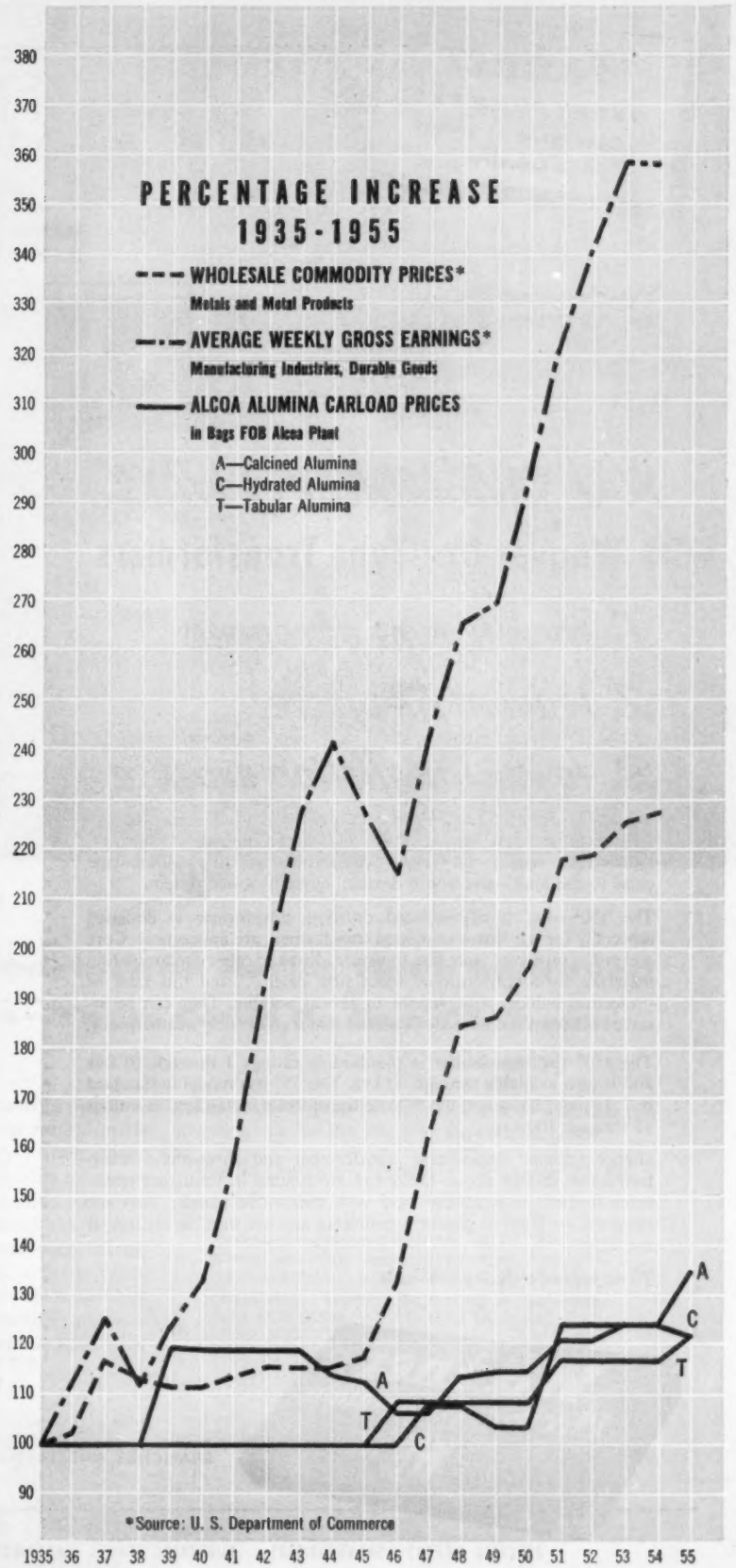
Here is a pricing record almost without parallel in the heavy chemical industry . . . and *you* have helped to make it possible. Constantly increasing tonnages —your orders—plus improved efficiency and equipment, have enabled ALCOA to maintain the price of chemical aluminas at a low and uniform level for more than 20 years.

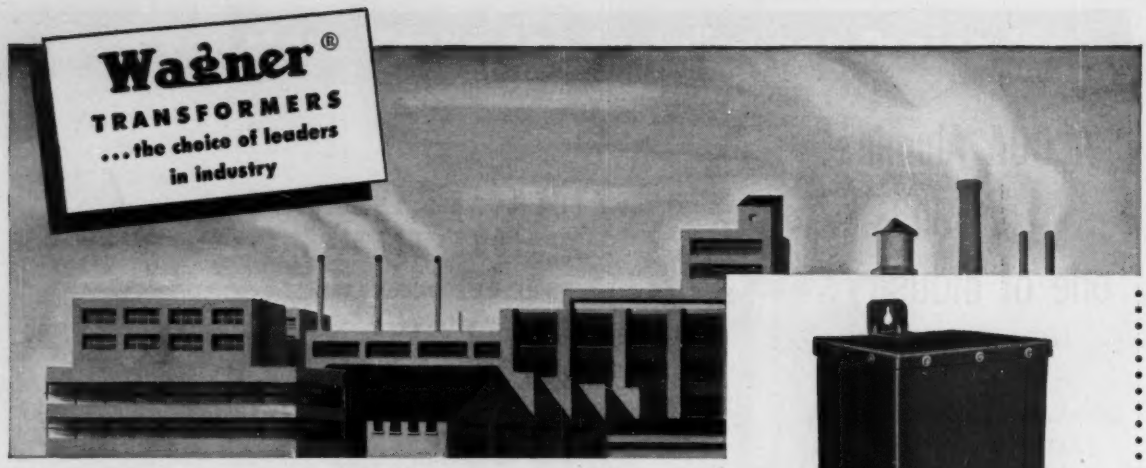
But many modern industries have discovered that ALCOA Aluminas are very special "best buys," regardless of price. They've found that wherever these versatile aluminum oxides are used, product quality is enhanced, performance is stepped up, processing is more easily controlled.

For example, ALCOA Aluminas make spark-plug porcelains more durable . . . abrasive wheels cut faster . . . refractories last longer, withstand higher temperatures. And ALCOA *Activated* Aluminas do remarkable things as catalysts and catalyst supports . . . dry gases and solids more efficiently than any other commercial desiccants . . . do an outstanding job in maintaining oils. Plastics, rubber, glass, textiles, china, enamel, cosmetics —a seemingly endless list of products— are better when they contain ALCOA Aluminas.

As in the past, ALCOA will maintain its prices at the lowest possible level. So, if ALCOA Alumina is not already one of your best buys, contact us right away. We would like to prove just how *good* a buy can be. Write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 702-B Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA CHEMICALS
ALUMINUM COMPANY OF AMERICA





YOU SAVE MONEY 3 WAYS
with Wagner Dry-Type Transformers

1. shorter runs of copper
2. reduced line losses
3. lower installation expense

For portable tools, machines or lighting systems, these compact, light-weight Wagner Dry-Type Transformers get the *right* voltage close to the load—give you a flexible, modern power system.

The 150° rise, totally-enclosed dry-type transformer is designed especially for use where ventilated transformers are impractical. Core and coil is protected from lint, moisture, dust and other contaminating materials by totally-enclosed sheet steel cases . . . and this kind of protection reduces maintenance to almost nothing. They can be installed outdoors, because their construction is completely weatherproof.

The 150° rise transformer is standard in ratings 3 through 10 kva and is also available through 50 kva. The 55° rise model is standard in 1, 1½ and 2 kva and the 80° rise transformer is standard in ratings 15 through 100 kva.

Higher voltage single-phase transformers and three-phase transformers in ratings above 112½ kva are housed in ventilated enclosures formed of structural steel with removable panels. They are designed for floor or platform mounting and are suitable for indoor use only.

Write today for Bulletin TU-57.

Single-phase
Dry-Type Transformer. 150°C.

Single-phase
Dry-Type Tranformer. 55°C.

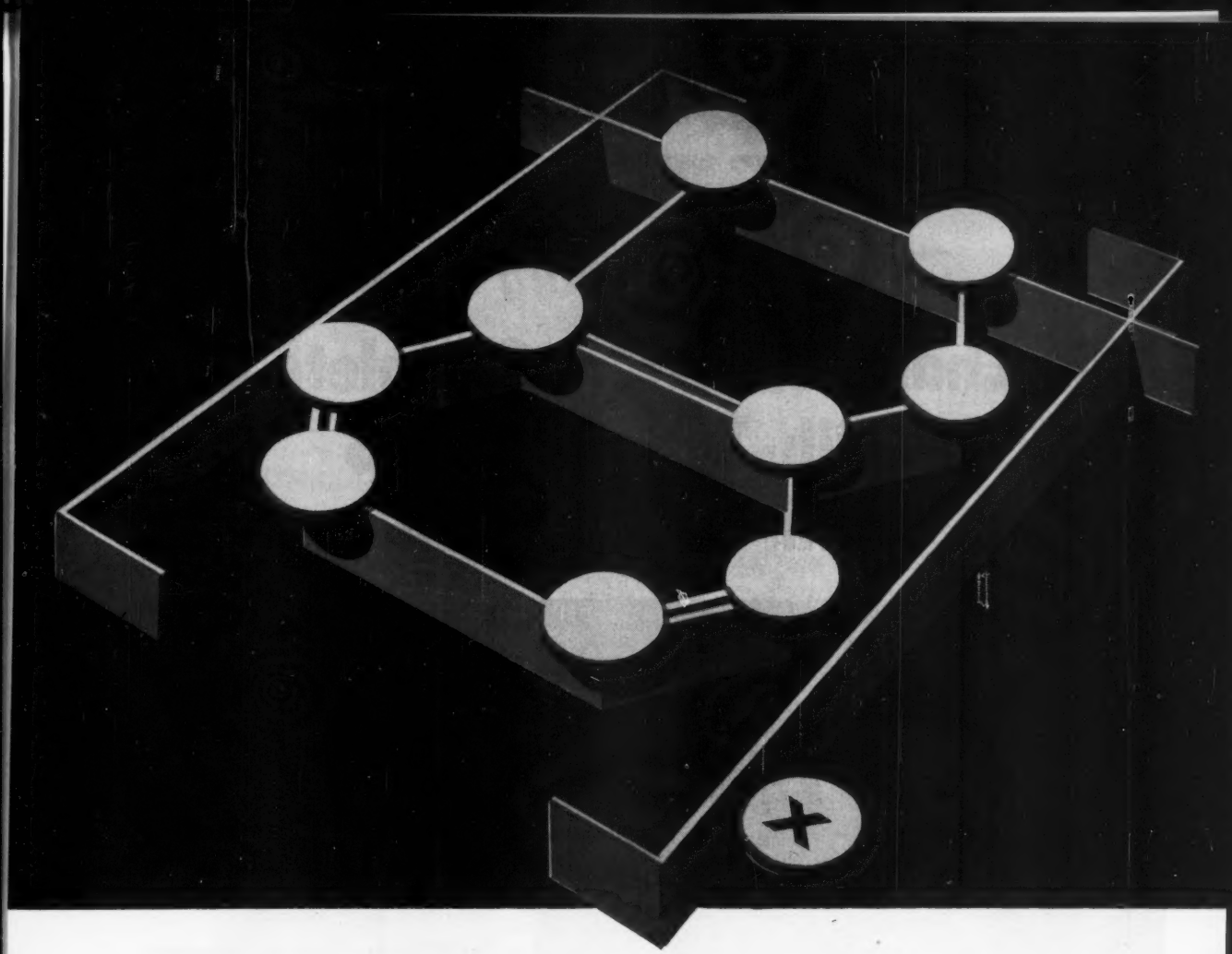
Three-phase
Dry-Type Transformer. 80°C.

Wagner Electric Corporation
6407 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

T56-3

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC



Neville Coumarone-Indene Resins Have Improved Many Products—Yours Could Be One Of Them

In the manufacture of many products from paints to rubber tires and floor tile to chewing gum, Neville resins have long proved their ability to help make better looking, longer wearing, more salable merchandise. Neville produces an extremely wide range of coumarone-indene resins under the most exacting of specifications, and conducts broad and constant research on their mutually profitable use in many types of products. If you have an item which is conceivably applicable, we suggest you send for further information. Without obligation, our chemists will work with yours in developing the application and selecting the proper grade for the job. Use the coupon below.

Neville Chemical Company • Pittsburgh 25, Pa.

Resins—Coumarone-Indene, Heat Reactive, Phenol Modified Coumarone-Indene, Petroleum, Alkylated Phenol • **Oils**—Shingle Stain, Neutral, Plasticizing, Rubber Reclaiming • **Solvents**—2-50 W Hi-Flash, Wire Enamel Thinners.

NEVILLE

Please send further information on Neville Chemicals.

NAME TITLE

COMPANY

ADDRESS

CITY STATE

There's MORE rating selection available in Allis-Chalmers MOTORS

To meet processing needs...

Allis-Chalmers Offers Complete Line of Rib-Type MOTORS from 1 to 100 Hp

Allis-Chalmers, a pioneer in rib-type TEFC motor design, is the only leading manufacturer offering a complete line of these motors from 1 to 100 hp. The many cost-saving features of deep-rib construction can be applied in a variety of uses... both indoors and out.

Here's why these motors can cut processing costs:

MORE cooling surface — Rib-type design provides reserve cooling capacity in dirty locations.

MORE iron—Cast-iron frame and external parts assure rigidity and resistance to corrosion.

MORE copper — Allis-Chalmers greater use of copper increases electrical life.

MORE lubrication provisions — Large grease reservoirs surround bearings. Provision made for in-service relubrication — important where moisture or corrosive vapors contaminate grease.

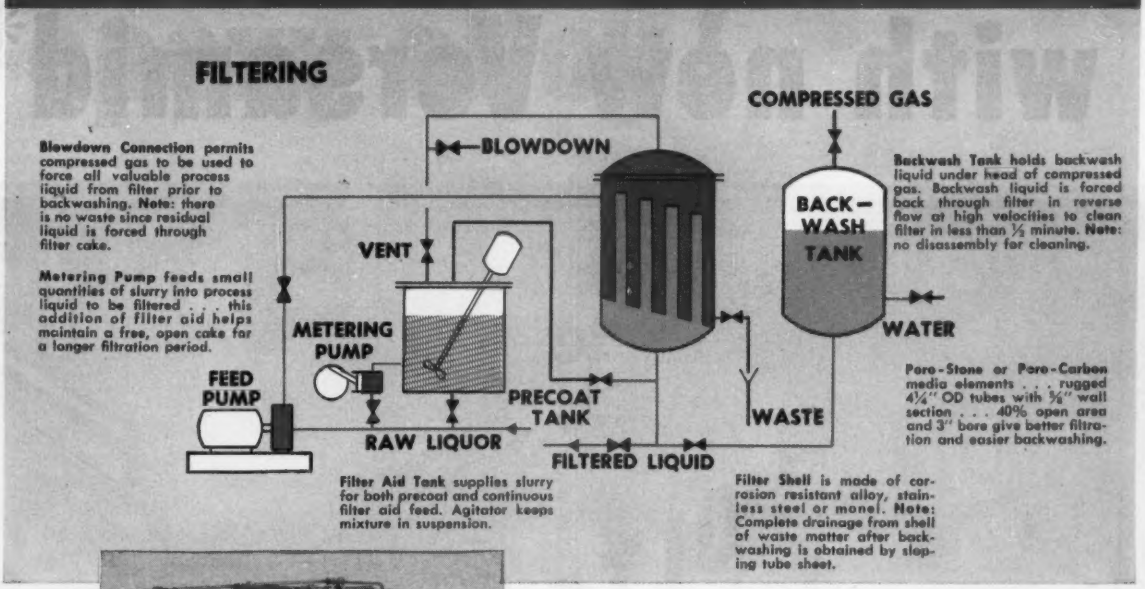
As a new machinery component or as replacement, specify Allis-Chalmers. To find out more, contact your nearby Allis-Chalmers distributor, district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

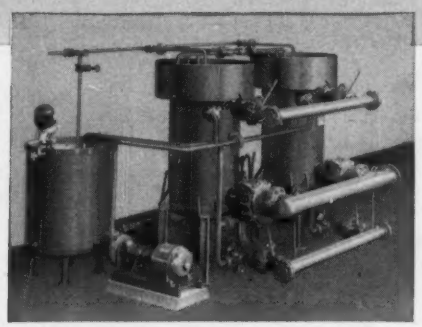
A-4947

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

FILTRATION: IMPROVED DESIGN GIVES HIGH PRODUCTION AT LOW COST FOR EXISTING PROCESS


FILTERING
COMPRESSED GAS
BLOWDOWN
Blowdown Connection permits compressed gas to be used to force all valuable process liquid from filter prior to backwashing. Note: there is no waste since residual liquid is forced through filter cake.
Backwash Tank holds backwash liquid under head of compressed gas. Backwash liquid is forced back through filter in reverse flow at high velocities to clean filter in less than ½ minute. Note: no disassembly for cleaning.
BACK-WASH TANK
VENT
Metering Pump feeds small quantities of slurry into process liquid to be filtered . . . this addition of filter aid helps maintain a free, open cake for a longer filtration period.
METERING PUMP
WATER
FEED PUMP
PRECOAT TANK
WASTE
Pore-Stone or Pore-Carbon media elements . . . rugged 4¼" OD tubes with ⅜" wall section . . . 40% open area and 3" bore give better filtration and easier backwashing.
RAW LIQUOR
FILTERED LIQUID
Filter Aid Tank supplies slurry for both precoat and continuous filter aid feed. Agitator keeps mixture in suspension.
Filter Shell is made of corrosion resistant alloy, stainless steel or monel. Note: Complete drainage from shell of waste matter after backwashing is obtained by sloping tube sheet.



Jacketed construction permits heating or cooling where accurate temperature control is required. Filter pictured also has submerged head to isolate hazardous chemicals in case of gasket leakage.

...LONGER RUNS, LESS MAINTENANCE BREAK BOTTLENECK

An Eastern dye and chemical corporation found sales outstripping its ability to produce one of its principal products.

Action was required!

A study of the process showed several steps of liquor clarification were being handled by old and possibly obsolete equipment. The result: a serious bottleneck was found. Excessive time and labor were needed to clean filter elements; dress the filter elements and maintain element frames.

The entire problem was presented to the R. P. Adams Co., Inc. A factory engineer and the local sales representative studied the problem.

Because of the nature of the process liquid, there was some question as to which of three solutions to the problem would prove most effective: 1. bare element filtration; 2. filtration through a precoat cake of filter aid; 3. continuous filter aid feed during the process cycle.

A pilot filter capable of operating under all three conditions was shipped to the dye firm. There, under actual operating conditions, the continuous feed filtration system was found to provide the best results.

What were the results when the production filters were placed in use? Longer process runs, cleaning time reduced to 15%, no element dressing time required and virtually no maintenance time — high production at a much lower cost.

Maybe you have a process bottleneck due to old filtration equipment . . . or maybe you are designing a new process system and want the latest word in modern filters. The entire R. P. Adams organization and its field representatives will be glad to help you in any way possible.

R. P. ADAMS CO., INC.
207 East Park Drive Buffalo 17, N. Y.

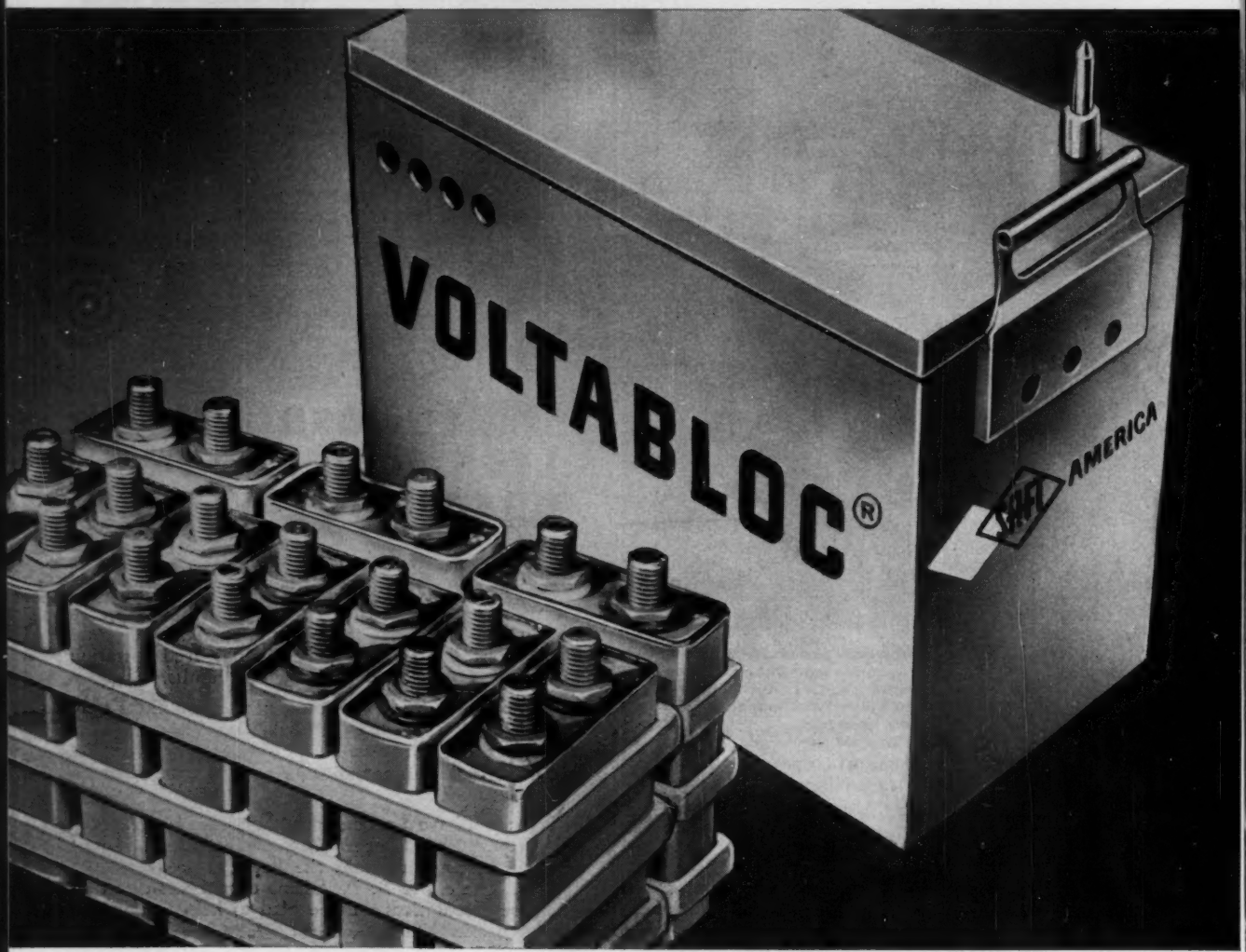
F-56

R. P. ADAMS COMPANY, INC.
207 East Park Drive
Buffalo 17, N. Y.

Gentlemen:
We have a problem in chemical filtration. Please send us your Bulletin 431. Also, ask your local representative to call on us. ☐

Name.....Title.....
Firm.....
City.....State.....

2 more "impossible" with new Versamid*



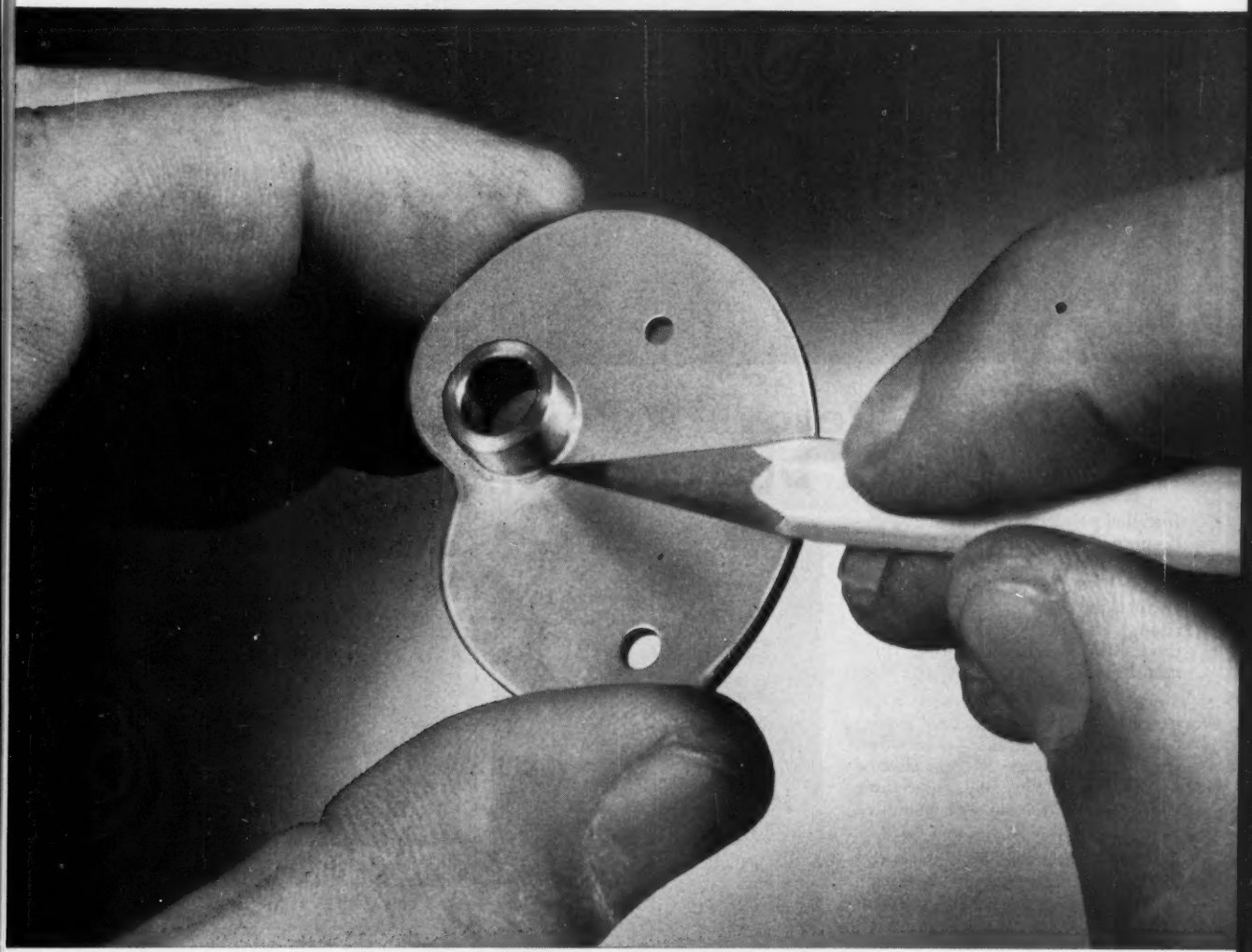
Five unique uses for Versamids give super storage battery nine lives. Versamid-based Bondmaster adhesive made by Rubber and Asbestos Corp., Bloomfield, N. J., is used (1) to secure brass nut to Taylor Fiber bar; (2) to bond plastic to copper alloy; (3) to secure polyester glass fiber to itself and to metal; (4) to secure glass fiber to itself, and (5) as a potting material. Only Versamid-based Bondmaster met the exacting demands of SAFT Corp., maker of the Voltabloc battery. Versamids alloyed with epoxy resins provided a 100% solids material that cures at room temperature and has high tensile strength. With Versamids, Rubber and Asbestos Corp. gained a new account and SAFT was able to make a product that outlasts several ordinary batteries. See how General Mills "opportunity chemicals" can help *you*. Eventually . . . why not now?

Complete test data and a wealth of facts on Versamid-epoxy adhesives are available in General Mills new Technical Bulletin 11-F.

***Investigate Versamids...**

the versatile polyamide resins made only by...

bonding jobs licked —epoxy alloy!



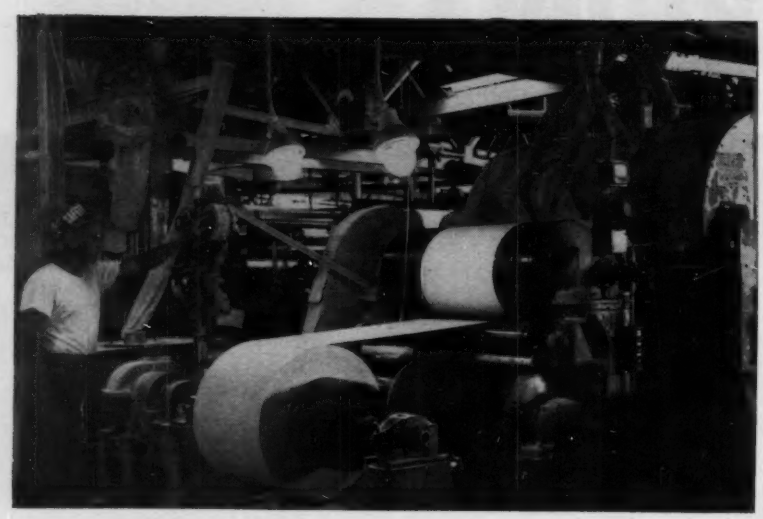
Saved: 47¢ per cam, by switching from soft solder to Versamid-epoxy adhesive for cam assemblies. With 89,600 cams in a contract, the Mechanical Division of General Mills saved $42,112, cut scrap loss drastically for a bonus saving. And adhesive bonding made the product, a radio receiver, better and stronger! Such case histories prove Versamid-based adhesives almost incredibly tough and tenacious. They're replacing welding, sewing, soldering, riveting in a growing list of industries. They bond almost any like and unlike materials fast and for keeps, with contact pressure only. Perhaps you can use a superlative adhesive like this. We'll be glad to tell you how General Mills Versamids can help. (Please note that General Mills does *not* make adhesives . . . only the Versamid polyamide resins that make such superior adhesives possible.)

CHEMICAL DIVISION of General Mills

KANKAKEE, ILLINOIS

DUST and FUME topics

WHEELABRATOR CORPORATION — Mishawaka, Indiana

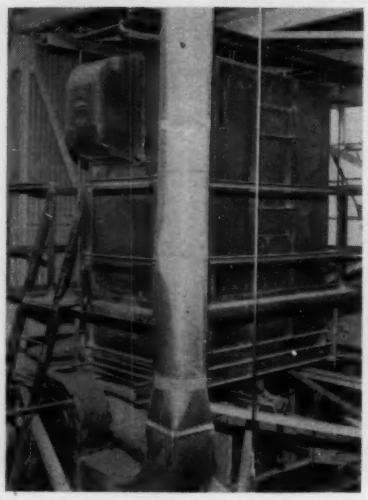


Cornstarch Recovery Pays for Complete Dust Control

Installed primarily to improve housekeeping by controlling the dust created by cornstarch used to dry coated paper, a Wheelabrator Dustube Dust Collector recovered enough of the cornstarch to pay for the entire investment within three months' time.

Since then this midwestern paper processor has installed two similar collectors to ventilate other dust creating equipment. Savings effected by product recovery with these three cloth tube collectors have amounted to $45,000 annually.

Other benefits provided are better working conditions and elimination of fire and explosion hazards through the virtually 100% collection efficiency of the three Wheelabrator Collectors.



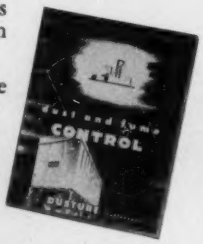
New Dust Control Principle Provides "Ultra-Filtration"

Wheelabrator cloth tube type collectors, with an inexpensive filter aid on the filtering surface of the cloth, give collection efficiencies of virtually 100% of atmospheric dust, including extremely fine micron sizes.

Ultra filtration with Wheelabrator Collectors is already paying dividends in sewage disposal plants, power plants, greenhouses, etc. . . . where "clean" air is a necessity. Write for complete details.

How to Save Money in the Control of Chemical Dust

Dust created in the manufacturing and processing of chemicals can be recovered at a profit with virtually 100% efficiency in a Wheelabrator Collector. In addition, worker efficiency is improved through better working conditions and maintenance costs are less because dust is kept away from machinery.



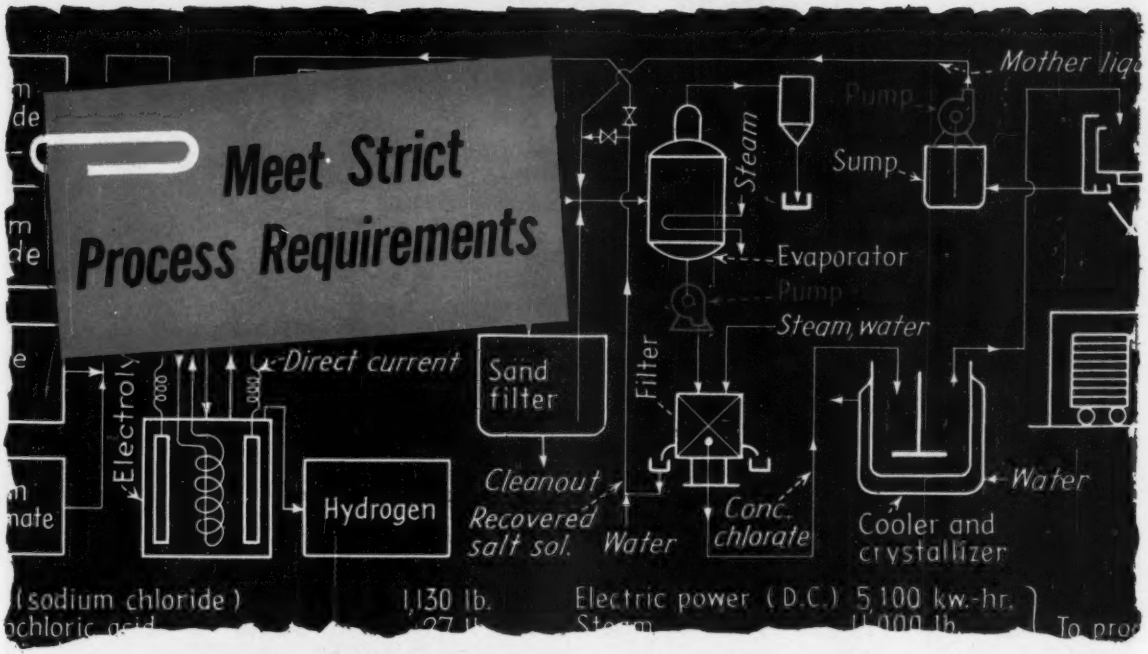
Get the complete story on Wheelabrator Dustube dust and fume control. Write today for Catalog No. 372C.

How Dust Free Can a Chemical Plant Be?

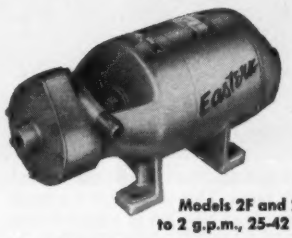
Packaging operations in this pharmaceutical plant are dust free through Wheelabrator Dust Control.

Wheelabrator cloth tube-type Collectors capture dust at the source before it has a chance to permeate the atmosphere. Any dry dust, regardless of particle size or concentration, can be handled. Virtually 100% efficiency is thus assured.

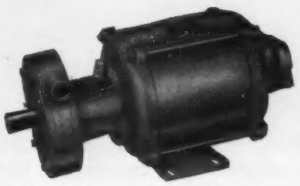
WHEELABRATOR
CORPORATION
(Formerly American Wheelabrator & Equipment Corp.)
347 S. Byrkit Street, Mishawaka, Indiana



. . . with Eastern Centrifugal Pumps



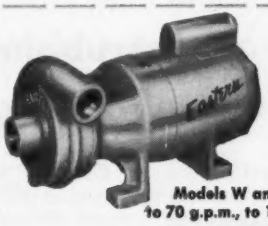
Models 2F and 2J
to 2 g.p.m., 25-42 p.s.i.



Model D-11
to 7.5 g.p.m., to 18 p.s.i.

Model F
to 17 g.p.m., to 17 p.s.i.

Models U-17 and U-34
to 38 g.p.m., to 21 p.s.i.



Models W and Z
to 70 g.p.m., to 11 p.s.i.

Models 3F and 3J
to 5 g.p.m., 29-65 p.s.i.

Recent redesign of these close-coupled Centrifugal Pumps has gained tremendous ruggedness and allowed for a wide selection of power requirements. In every detail of size, weight, space requirements, power, and costs, Eastern pumps fill the bill for strict process standards.

Six standard models range from 1/8th to 3/4 H.P., with capacities up to 70 G.P.M., pressures to 65 P.S.I. Eastern Centrifugal Pumps are available in Cast Iron, Bronze, Stainless Steel, Monel, and Hastelloy "C".

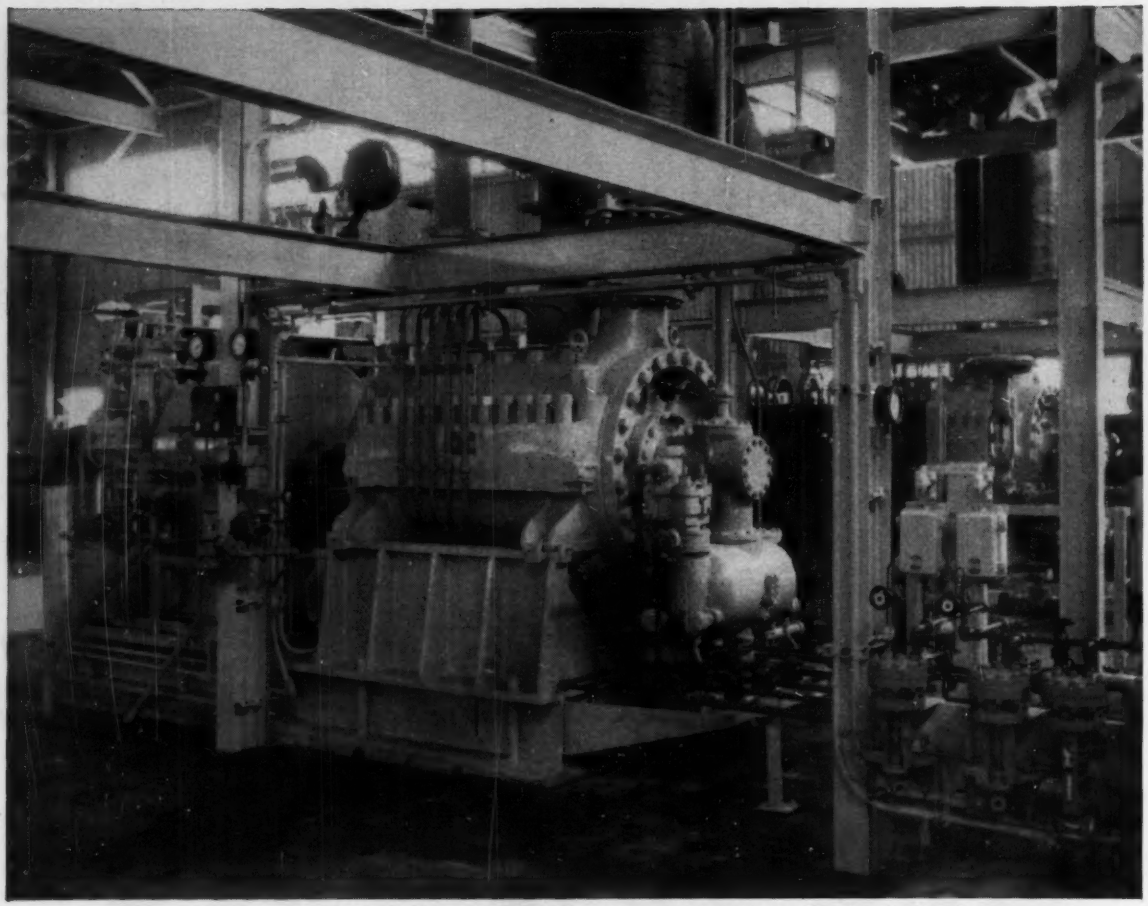
Eastern's engineering service offers many special models to meet your specific needs as to capacity and construction. Recommendations entail no obligation, and your inquiries are invited.

NEW EASTERN CATALOG

Eastern Centrifugal Pump Catalog contains engineering data, performance charts, diagrams and helpful general information. Request Bulletin 110F.

Eastern

INDUSTRIES, INC.
100 SKIFF ST.
HAMDEN 14, CONN.



ONE OF TWO WORTHINGTON CENTRIFUGAL COMPRESSORS keeping the temperature — and cost — *low* in ammonia processing at Lion Oil Company's plant. This unit cools a copper solution used to scrub NH_3; and chill and condense the compressed NH_3 gas to a liquid state.

Ammonia gets low-cost scrubbing and chilling with Worthington compressors

Every day 20 million cubic feet of natural gas are used in producing 300 tons of anhydrous ammonia at Lion Oil Company's Barton Plant in Luling, Louisiana — and nothing goes to waste!

Part of the credit for this efficient operation goes to two new Worthington centrifugal compressors which chill and scrub ammonia gas during the synthetic process. Unlike ordinary compressors, the new Worthington units employ interstage liquid ammonia injection — an exclusive feature that effectively reduces the heat of compression and thereby more efficiently converts velocity energy into pressure.

Choice of the Worthington compressors was based largely on this efficient design which has already introduced new economies into the Barton Plant operation. The centrifugal units, each rated at more than 1300 tons capacity, are powered by reliable Worthington steam turbines.

Worthington centrifugal compressors may be the answer to low-cost, high-volume processing in your plant, too. Find out how these units put big chilling jobs on a more profitable basis by writing Worthington Corporation, Air Conditioning & Refrigeration Division, Section A.5.61-CG, Harrison, N.J. A.5.61

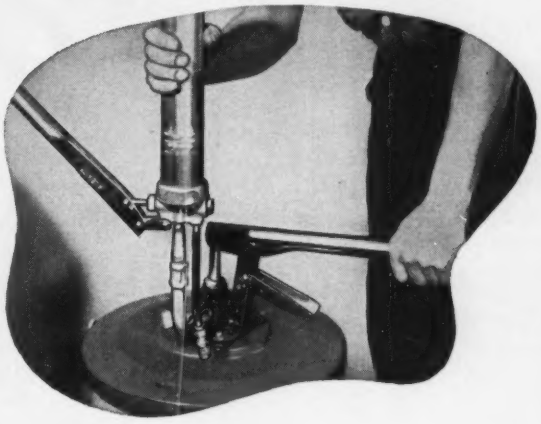
WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

YOUR PRODUCTION GOES UP...

when you switch lubrication methods from

Backward to Forward!



ALEMITE HAND GUN WITH LOADER PUMP

reduces downtime...cuts man-hours

...saves right down the line!

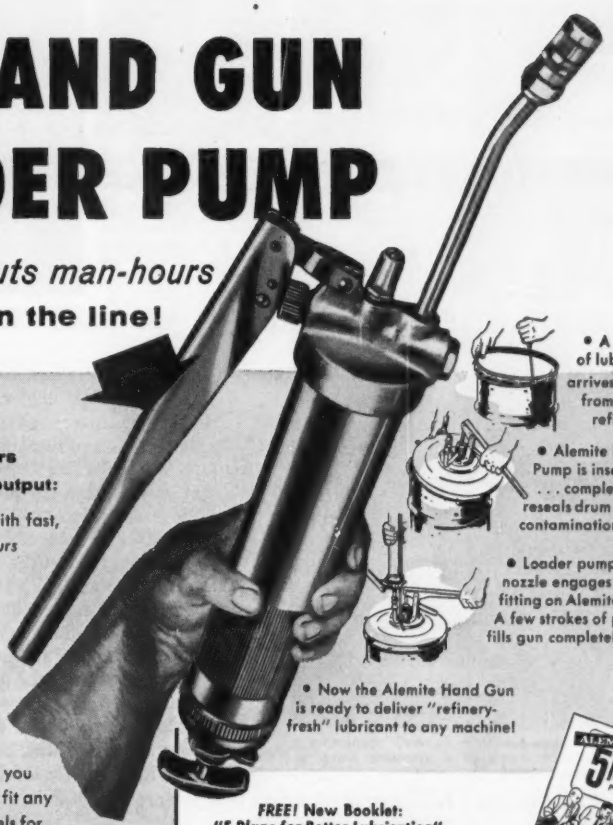
Why more and more plant managers look to Alemite lubrication for greater output:

Time studies prove it! Refilling hand grease guns with fast, efficient Alemite Loader Pumps saves you *15 man-hours* for every 400-pound drum of lubricant, compared with loading the old-fashioned hand-and-paddle way!

You eliminate the cost, mess and fire hazard of "oil-room" spillage. With Alemite equipment you can *transfer, load and apply* lubricant that you know is *completely* free of dirt, grit or abrasives. Machine-hours are saved, too! With better lubricated bearings, machines stay new longer!

Alemite can furnish a hand gun of correct capacity for your operation—from 8 ounces to 2 pounds. And you get the pressure you need—up to 15,000 pounds! There is an Alemite Loader Pump to fit any standard lubricant container you normally use—stationary models for 100-lb. and 400-lb. drums; portable models for 25-lb. and 35-lb. pails.

Ask your nearest Alemite supplier for full details.



• A drum of lubricant arrives—fresh from the refinery.

• Alemite Loader Pump is inserted . . . completely reseals drum against contamination.

• Loader pump nozzle engages fitting on Alemite gun. A few strokes of pump fills gun completely.

• Now the Alemite Hand Gun is ready to deliver "refinery-fresh" lubricant to any machine!

ALEMITE

REG. U. S. PAT. OFF.

Ask anyone in industry

A PRODUCT OF SW STEWART WARNER

***FREE!* New Booklet:**
"5 Plans for Better Lubrication"
Alemite, Dept. CC-26, 1850 Diversey Pkwy. Chicago 14, Illinois

Please send me my FREE copy of "5 Plans for Better Lubrication."

Name .....

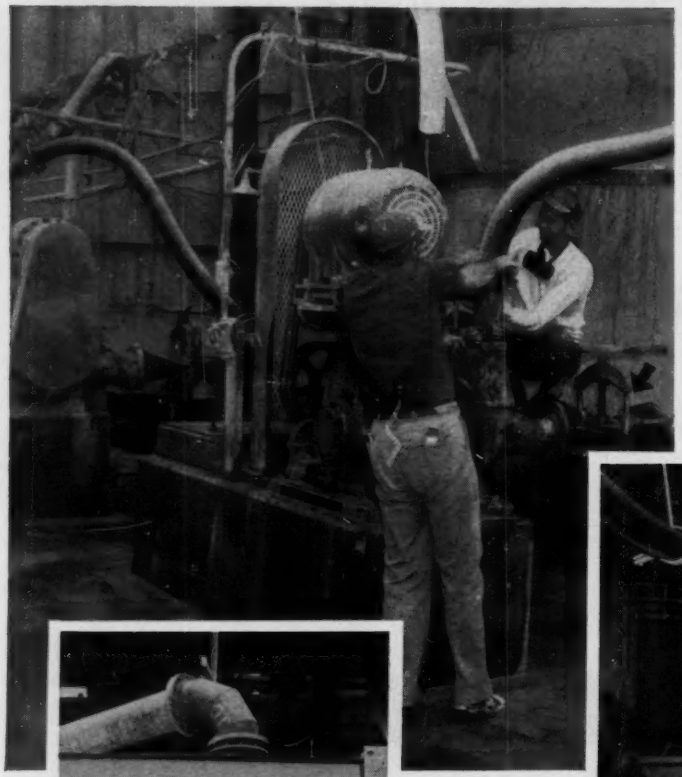
Company .....

Address .....

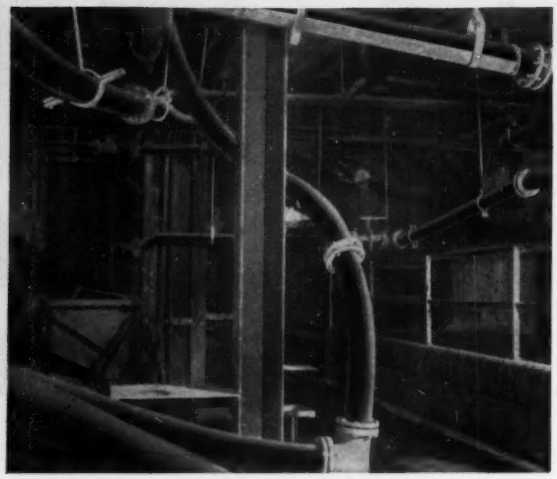
City ..... State .....

"WE DON'T HAVE TIME TO CODDLE PIPING OR VALVES— SO WE USE U. S. RUBBER PRODUCTS . . ."

says production official of phosphate chemical plant



The U. S. Rubber Pilot pinch valve (arrow) connects to the big tank in the background (with U. S. Giant Acid Hose at right) and serves to control the flow of acid, gypsum and solids to the digestor tank, from the pump.



U. S. Rubber Pilot pipe, dominates this picture of slurry tanks for first stage filters. Note also U. S. Acid Hose.

U. S. Expansion Joint (arrow) connecting a leak-proof fitting to a vibrating pump in phosphate plant.

This large plant in Florida operates 24 hours a day, 7 days a week, making fertilizer and animal food supplements. Corrosive acids, (phosphoric and sulphuric) flow freely, and without damage, through U. S. Rubber Giant® Acid Hose. "Metal hose would clog, corrode and crack," says the production official of the plant. "We also use U. S. Rubber Pilot® Pinch Valves—because they don't clog, freeze or need to be babied like metal valves."

This plant also uses U. S. Expansion Joints and U. S. Pilot Pipe and U. S. Giant Acid Hose to control, pipe, pump and convey the flowing semi-solid acids. All of these products are easy to install, easy to clean and maintain. The plant's officials have found that U. S. Rubber products are unmatched in facilitating production and in reducing maintenance and equipment charges. They have standardized on "U. S." products. It will pay you to take any and all corrosion problems to a "U. S." specialist. Get in touch with any of our 27 District Sales Offices, or write Mechanical Goods Division, United States Rubber, Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

United States Rubber

Bendix

GENERAL PURPOSE DIGITAL COMPUTER

FOR ENGINEERING AND SCIENTIFIC COMPUTATION

FASTER
IN COMPUTING TIME
Multiplies in 16.7 milliseconds
Divides in 16.7 milliseconds
Adds in 0.54 millisecond
—including reading of command.
LOWEST
IN COST
The modest first cost results from the advanced design of Bendix Aviation Corporation engineers. Low maintenance is assured through conservative use of all electronic components.
LARGER
IN COMPUTING CAPACITY
2170 word memory.
As many as 1,200,000 additional words can be stored in auxiliary magnetic tape units.
SMALLER
IN PHYSICAL SIZE
Approximately equivalent in size to 2 standard 4-drawer filing cabinets.
Standard 115V 60 cycle current is used.
. . . AND AVAILABLE
NOW !

MAIL THE COUPON OR WRITE FOR COMPLETE INFORMATION

Bendix Computer

BENDIX COMPUTER DIVISION, Bendix Aviation Corporation
5630 ARBOR VITAE STREET, LOS ANGELES 45, CALIF.

Please send information and prices on your G-15A Computers.

NAME_____ TITLE_____

COMPANY_____ ADDRESS_____

THE BENDIX G-15A WILL BE EXHIBITED IN TULSA AND HOUSTON DURING FEBRUARY. FOR AN INVITATION PLEASE WRITE THE SALES DEPARTMENT.

Virtually Universal Corrosion Resistance*
plus Fast, Simplified Assembly

*excepting only hydrofluoric acid and hot caustics

"US" CHEMICAL PORCELAIN
with cemented-on ASME 125 lb. standard metal flanges

PIPE
FITTINGS
VALVES
COCKS
POT OUTLETS
JAR OUTLETS
TANK OUTLETS
TOWER OUTLETS
FILTER OUTLETS

Chemically inert, dense, strong and iron-free, "US" Chemical Porcelain Piping and Process Equipment solve the toughest problems in corrosive materials handling, while maintaining absolute purity of solution. When equipped with metal flanges there is an important added advantage — speed and simplicity of installation. Flanges bolt together quickly and easily using ordinary tools . . . forming a strong, rigid, pressure-sealed joint. Down time is held to a minimum. Connections can be made directly to other types of pipe and equipment having ASME standard flanges, adapters are available for connecting to other than ASME standard fittings, but are rarely needed.

Pipe and equipment to which flanges are to be affixed are formed with plain, straight ends and smoothly ground gasket surfaces. Standard flanges are of high grade cast iron, aluminum flanges are also stocked and furnished where specified. Both types comply with ASME standard for number of bolts and size of bolt circles. Extreme care is used in positioning and cementing flanges to assure perfect alignment.

Consider for a minute how your operation can benefit from the outstanding corrosion resistance and iron-free quality of "US" Chemical Porcelain Piping and Equipment . . . and the faster, simpler installation afforded by flanged fittings.

Write for Bulletin CP-50 and C-5

217-E

PROCESS EQUIPMENT DIVISION

U. S. STONEWARE
AKRON 9, OHIO

FEBRUARY 1956 ·

Chementator

H. T. SHARP

√ Foote Mineral is readying a new electrolytic unit to make metallic lithium. It's touted as quite different from government-developed units now used.

√ Radioactive wastes from nuclear piles have been used in Britain to make lab amounts of polyethylene from ethylene gas. Process is also said to work on methacrylates and styrene.

√ It isn't ready to talk about it yet, but Lummus now has rights to a new European-developed urea process.

√ Standard Oil (Ind.) is expected to start work on a plant to use Scientific Design's xylene oxidation process by fall. Still a secret, the process likely involves liquid-phase catalytic air oxidation.

To try Stamford process for N_2O

A recently developed process for nitrous oxide gas will get its first U. S. trial in a $1½ million plant now being built in Berkeley, Calif., by Ohio Chemical Pacific Co., a division of Air Reduction. Due on stream in April, the new plant will make 70 million gal./yr. of liquefied N_2O available to West Coast users.

Chief uses are as an anesthetic and as propellant for a growing number of food products—from whipped cream to pancake batters to toothpastes.

Many features of its new plant are unpatentable, so Ohio won't divulge processing details. But it's known that the Stamford process, which it plans to use, continuously decomposes an 83% ammonium nitrate solution (technical grade) in a stainless steel retort at under 390 F.

Conventional batch processes, used at Ohio's San Francisco plant—now outdated by limited capacity and poor location—and by others, need very pure solid ammonium nitrate. This breaks down when heated above 390 F. Washing the resultant gases with caustic removes nitric acid and a dicromate wash takes out nitric oxide. N_2O is then liquefied at about −130 F.

Ohio expects the continuous process to drastically simplify product testing, allow more complete control of process variables and, since decomposition conditions are less severe, be more troublefree. The plant is designed so that its capacity can readily be doubled if use of nitrous oxide as a food propellant continues to grow as anticipated.

New process slashes dimethyl sulfide cost

Crown-Zellerbach has just started up a 2 million lb./yr. pilot plant for dimethyl sulfide at its Camas, Wash., pulp mill. Using a new Swedish-developed process, it will cut tank-car prices from 23 to 15¢/lb.

The lower price tag should help dimethyl sulfide carve its way into four major markets:

• Base for sulfoxide and sulfone solvents.

• Sulfur carrier in both agricultural and rubber chemicals.

• Odorants and masking agents.

• Chemical intermediates.

The patented (U. S. 2,711,430) process is simply a loop superimposed on the usual black liquor (spent kraft digester liquor) treatment cycle. C-Z takes a slurry (55% solids) of black liquor from the evaporators, adds sodium sulfide in proportion to the concentration of methyl groups present and pumps the slurry to a continuous reactor. After reacting for 10 min. at 480 F. and 600 psi. the mixture is flashed and the vapors condensed.

This recovers the dimethyl sulfide, some methyl mercaptan (10-15%) and some heat values. Methyl-free effluent goes back to the proper stage of black liquor evaporation for the rest of the treatment cycle.

Other dimethyl sulfide producers, Sharples Chemical and Hercules, are wary about cutting their prices until they've had a chance to size up C-Z's product. Both hope that it will not prove direct competition.

Currently, Sharples makes a high purity (99%) product from methanol and byproduct hydrogen sulfide; Hercules a lower purity (63%) from its sulfate turpentine distillation.

But if the expected markets develop—C-Z itself is looking at it as an intermediate for captive production of other chemicals—a full scale commercial plant could push the price below 10¢/lb. C-Z estimates that 75 million lb./yr. could be recovered from its own operations and the entire kraft industry could supply about 700 million lb./yr.

Worker unions to launch new drives

February's meeting of the executive council of the newly merged AFL-CIO is expected to fire the starting gun in the biggest organizing drive ever to hit the chemical process industries.

At the meeting, remaining jurisdictional squabbles will be settled and both AFL and CIO chemical and oil worker unions, will launch new membership drives, aided by staff and money of AFL-CIO. Walter Reuther, AFL-CIO vice president, has been pushing for more intensive organizing effort in these industries for some time, so organizers can count on high level backing.

Chemical plants in the South will likely get the most attention. Here unionizing has met the greatest resistance, a challenge laborists can't ignore. They also aim to rally workers now in independent unions.

To coordinate the drive, committees of two of the major chemical unions—the Oil, Chemical & Atomic Workers and the International Chemical Workers Union—are meeting this month, too. They'll also study merger proposals, so don't be surprised if the two groups are welded by the year's end.

Independent unions aren't taking the threat of bigger raids by AFL-CIO meekly. Feuds are smoldering even now. In a defensive measure, some 2,500 independents of all kinds recently announced plans to federate. And four of the biggest oil independents just formed a new group which will give them a big voice in this confederation.

Coming negotiations will see wider use of a tool relatively new to chemical bargaining—company-wide and sub-industry-wide councils. Used in place of plant-by-plant talks, these help the union coordinate bargaining tactics.

But while bargaining will be aggressive, strikes will be relatively few. They simply cost too much—diverting money from organizing.

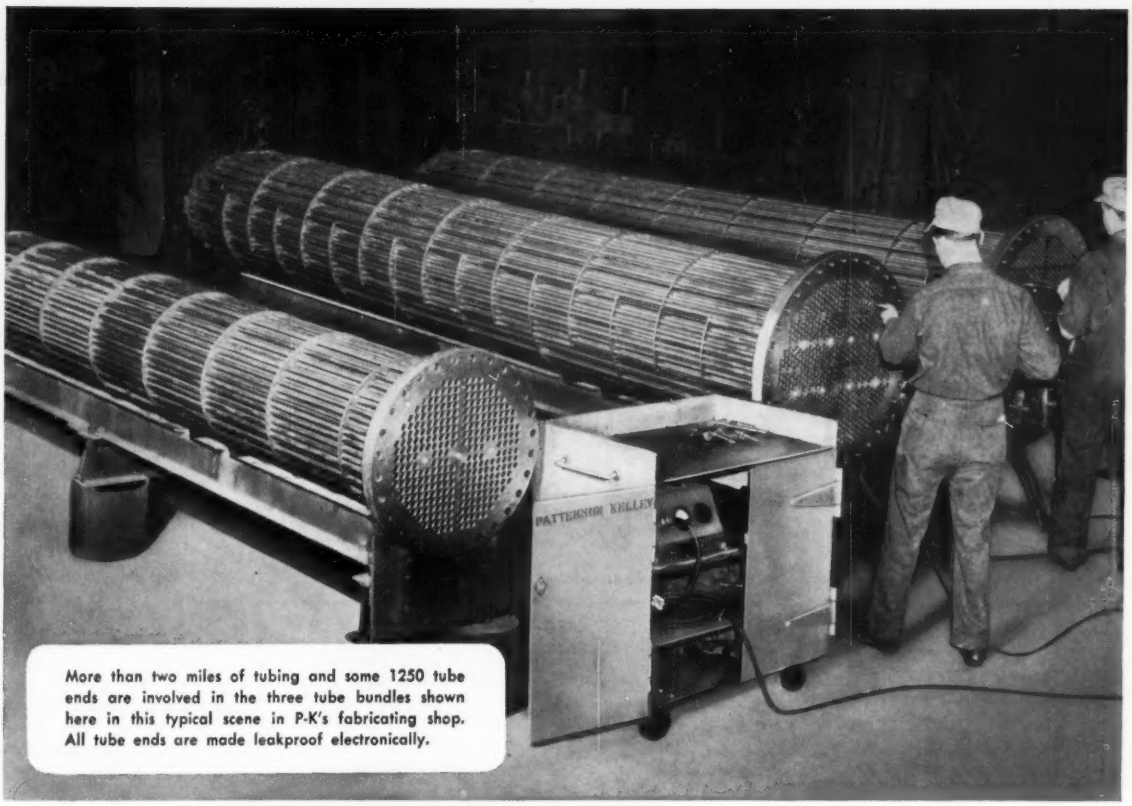
Pressure-refined aromatics plant likely

If current talks with steel companies bear fruit, Koppers will soon break ground for the first U. S. plant to catalytically pressure-refine coke oven aromatics. A growing clamor for higher purities and the success of the German-developed Scholven Chemie process will be prime factors behind such a decision.

Chemical industry customers of steel's benzene, toluene and xylenes are voicing demands for purer materials—or lower prices. The Scholven Chemie process (*Chem. Eng.*, Sept. 1952, p. 220), to which Koppers recently acquired rights, is said to cut thiophene content to under 1 ppm. and yield a product whose solidification point (after paraffin removal) is 5.4 C. This is a significant improvement over the acid wash purification method now used.

Scholven mixes coke oven gases and hydrogen at 150 atm. with aromatics, heats the mixture to 390 F. and passes it through a polymerizer. Heated again by adding coke gases at about 850 F., the mixture goes to a vaporizer where raw aromatics distill off and the residual, holding about 98% of the po-

(Continued on page 110)



More than two miles of tubing and some 1250 tube ends are involved in the three tube bundles shown here in this typical scene in P-K's fabricating shop. All tube ends are made leakproof electronically.

HOW ELECTRONICS MAKES P-K EXCHANGERS BETTER THAN EVER

These men are expanding tube ends into the tube sheet—the "inner face" of a shell and tube heat exchanger that holds each tube in place. It's a time-consuming, precision-demanding job. Yet by doing it *electronically* with the equipment you see here, the circumference of *each* tube is joined to the face of the exchanger with exactly the same pressure. The fit is as nearly perfect as modern science can achieve. No leaks can develop in service because of the precise and uniform expansion of the tubes.

Electronic expansion of tubes is an example of how the fabrication of heat exchangers has changed since **p-k** built its first unit in 1880. But the fundamental method of building a good heat exchanger, like the shape and form of a shell and tube unit itself, has changed very little. The thermal design must be *right* . . . the craftsmanship *exact* . . . the testing *scrupulous.*

Leading engineers and contractors know these facts. They know, too, that such painstaking care costs money . . . that minor price advantages are often illusory . . . that the integrity of the manufacturer is their best safeguard . . . and that one maker has never compromised with quality.

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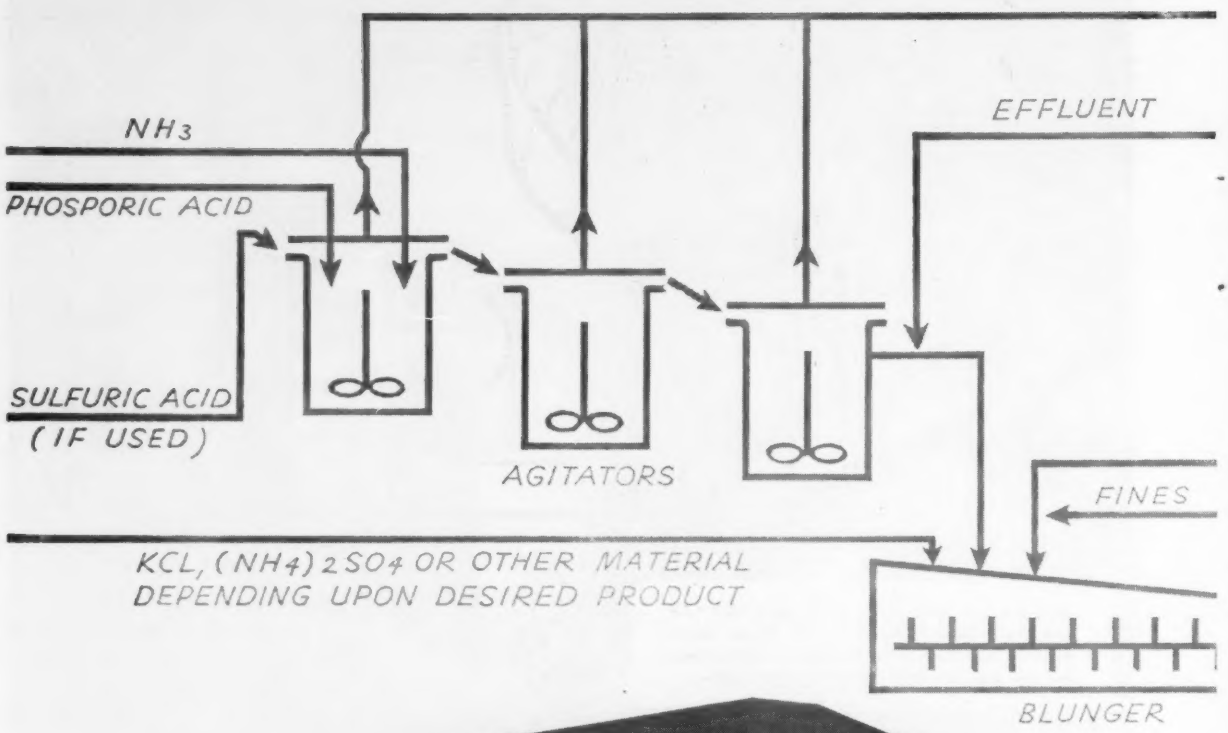
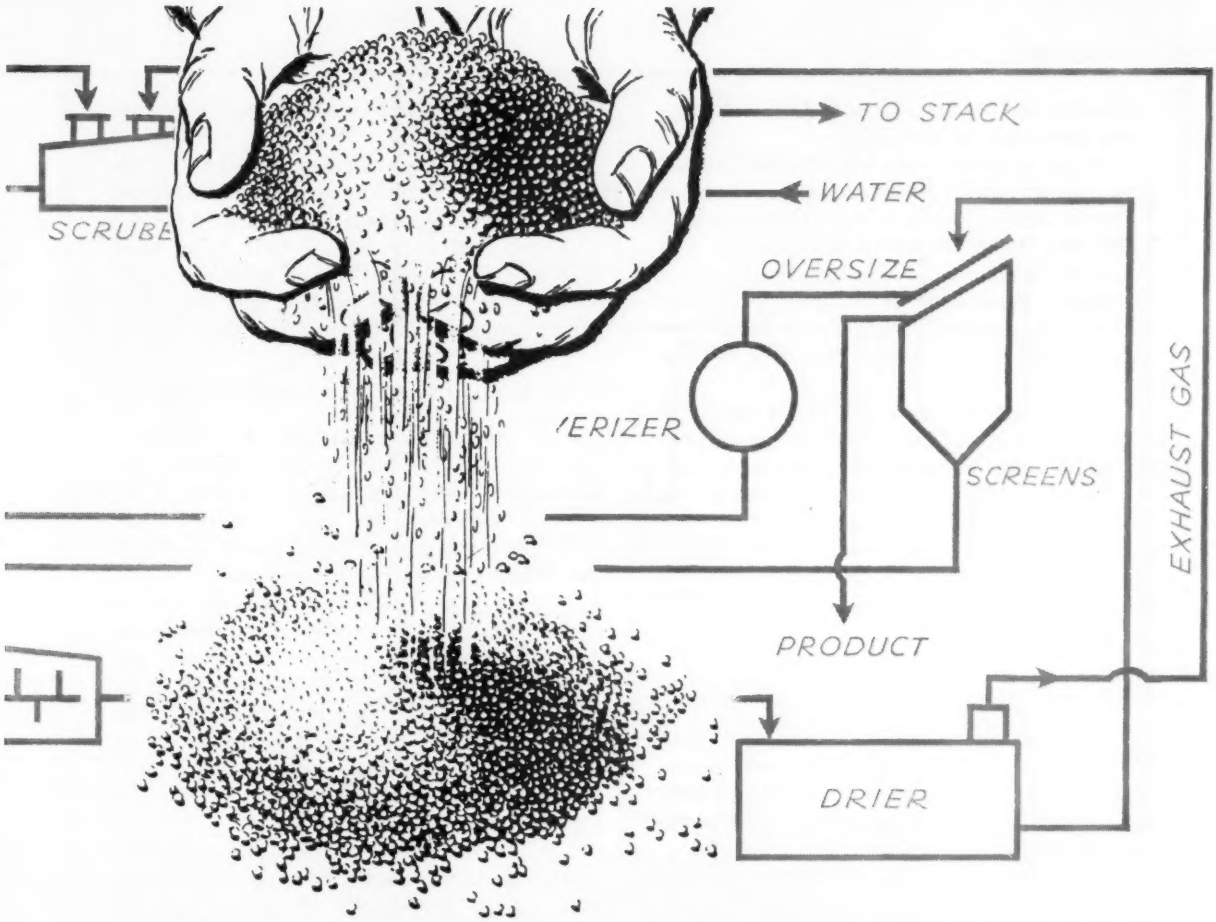


NEW!

The Dorrco Diammonium Phosphate Process



Proved out at Missouri Farmers Association Granular Fertilizer Plant...

The first commercial production of diammonium phosphate based fertilizers took place last November at the new MFA Fertilizer Plant near Joplin, Missouri. Full design capacity of 200 TPD was reached less than three months later. An improvement in the Dorrco Granular Fertilizer Process, this new method can be readily adapted to existing plants.

The Dorrco Diammonium Phosphate Process can produce directly from 32% P_2O_5 acid a fertilizer analyzing approximately 18-48-0 (N-P_2O_5-K_2O basis). Iron, alumina and other elements go directly into the product where they assist granulation. The use of dilute phosphoric acid, purification by filtration and crystallization are all avoided. Final product is composed of closely sized, spherical, free flowing granules and size can be controlled over a wide range by proper selection of screens. The presence of a small percentage of monoammonium phosphate insures stability of the product.

If you're interested in diammonium phosphate fertilizers, let us send an engineer to discuss this new development from the standpoint of economics and process. No obligation, of course.

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tentially troublesome unsaturated hydrocarbons, condenses to pitch.

After reheating, the vapors enter a catalytic reactor where an alumina-base catalyst converts sulfur, oxygen and nitrogen contaminants to hydrogen sulfide, water and ammonia respectively. Chilling liquefies the aromatics, separating them from the gases which are recycled. Output of pressure refining is about 10% better than that of acid washing.

Only apparent drawback is the need of a large installation for economic operation. Germany's first commercial plant had a 5,000 tons/mo. capacity, subsequently trebled. The German plant serves several neighboring steel mills, a situation which could be duplicated here at Pittsburgh, Pa., Gary, Ind., and Birmingham, Ala.,—all likely sites for the first U. S. plant.

More Gulf Coast expansions slated

Chemical engineers along the Gulf Coast will be mighty busy if current expansion plans gel. Butadiene, synthetic rubber and polyethylene all figure prominently in upcoming projects. Here are a few examples:

- Firestone's brief announcement that Catalytic Construction Co. was awarded a contract to engineer a 40,000-ton butadiene plant will likely result in construction activity at Lake Charles, La., in the late spring.
- Petroleum Chemicals Inc., owned jointly by Continental Oil and Cities Service, will spend over $4.3 million to up its Lake Charles butadiene capacity from 63,000 to 79,000 tons/yr.
- Phillips Chemical is another planning a butadiene boost. It will hike capacity of its Borger, Tex., unit by 25,000 short tons/yr., and raise synthetic rubber capacity some 30,000 long tons/yr.
- General Tire and El Paso Natural Gas have teamed to add 40,000 long tons to synthetic rubber capacity with the nation's first postwar, privately-financed and completely-integrated operation set for Odessa, Tex.
- Celanese admits that it has new Texas-based expansions in the preliminary planning stages, but declines to comment on speculation that a Phillips' process polyethylene plant (Chementator, Dec. 1955) is included.
- Grace Chemical says that the Gulf Coast is "one of several" possible sites for its polyethylene plant (also Phillips-licensed, Chementator, Dec. 1955), but a decision may not come for a few weeks.

Other activity includes Arizona Chemical's new tall oil plant now being engineered for Springhill, La., Shell Chemical's 40 million lb./yr. methyl ethyl ketone unit being built at Norco, La., Texas Co.'s oil additives plant planned for Port Arthur, Tex., and American Oil's methyl mercaptan plant at Texas City.

Launching new study of engineering

At its January meeting the executive committee of the Engineers Council for Professional Development was scheduled to receive a sub-committee report defining and delineating the scope of a proposed survey of the entire engineering profession.

The survey, probably to be patterned on earlier studies of the medical, legal and dental professions, was first proposed at ECPD's fall meeting in Toronto. ECPD's executive committee accepted the idea and passed it on to the subcommittee to determine the objectives, ground to be covered and limits to be set on it. Problems of time and cost also came in for scrutiny.

After studying its report, the executive committee is expected to name a larger group to work out the details of how to get and evaluate answers to the questions raised. And how to staff and pay for it.

Expected to take several years to complete, the survey will attempt to give answers to such questions as how many engineers are there, where do they work, how are they used, how were they trained, etc.

More "cold combustion" advances aired

It may not be as spectacular or as well-publicized as the competition in the nuclear energy field, but the race to get electric power via "cold combustion"—without intermediate boilers, turbines or generators—is just as hotly contested.

Newest developments center in West Germany where a cell which combines hydrogen and oxygen to produce electricity directly was recently described. Similar to the English-developed Bacon cell (*Chem. Eng.*, Sept. 1955, p. 136), it produces a current when oxygen at about 22 psia, diffuses through a porous coal cylinder, reacts with a potassium hydroxide

(Continued on page 112)

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The sparkling crystals pictured above show a small section of an alum "cake" just after crystallization. Soon these icy white "stalactites" will be processed into one of the many forms in which General Chemical offers its Ammonia and Potash Alums. What the picture can't show is the unusually high quality and uniformity for which "G.C." crystal alums are known.

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electrolyte to form hydroxyl ions which migrate to and react with hydrogen as it diffuses through a porous nickel cylinder.

Major advantages claimed for the new cell include cooler operation (212 F. vs. 392 F. for the Bacon cell), lower pressure (near room vs. 600 psi.) and use of gases of normal technical purity.

Work isn't far enough along to permit realistic cost studies, but with workable models developed, applications research is being pushed. In addition to England and West Germany, researchers in the Soviet Union, Belgium, Switzerland and the United States are known to be working on similar projects.

Enthusiasts claim that "cold combustion" is safer and will prove cheaper than nuclear fission as an energy source.

Uranium from lignite yields troubles

Chemical and oil companies which bought up uranium bearing lignite deposits in the Dakotas in hope of extracting the uranium and selling it to the Atomic Energy Commission for a profit are reaping disappointments instead.

To begin with deposits are generally quite lean—with 0.2-0.3% considered a pretty rich holding. (Although reports are current of an oil company holding which assays between 0.5-1.0% uranium.)

In addition, some complicated problems arise in trying to recover the uranium. If you grind up the lignite for leaching out the metal, the equipment gets clogged by the 40-70% carboniferous material. If you burn it first to get rid of this, planning to separate the uranium from the ashes, it will form a complex, making these values unavailable.

For the same reason, the temperature of the ore roasting process used on uranium-vanadium ores from the Colorado plateau must be closely controlled. Roasting at about 1,150 F. solubilizes the ore for later separation, but letting it rise to about 1,400 F. makes a complex which sharply cuts the possible yield.

Researchers in industry, government and universities are at work on uranium-from-lignite processes, but none appears to have one now ready to leave the lab. However, engineers close to the problem say that process troubles aren't any worse than with similar projects, that the main drawback is lack of an AEC price schedule for the product.

Companies with lignite holdings, and a possible market for the material as a power plant fuel, say that they'll go into business if AEC will guarantee a market for the ash. But AEC doesn't want to commit itself, because the potential uranium supply from known lignite deposits is quite small compared to uranium ore reserves.

However the commission says that if a company goes ahead with a lignite-burning plant, it may be interested in buying the ash—but not to count on this when figuring plant economics. So far there are no takers.

New irradiated plastic nears market

A new irradiated plastic insulator for electric wiring may out-date 125 C. polyvinyl chloride coatings before they even reach market. Just developed by Sequoia Process Corp., Redwood City, Calif., the new insulator aims for high temperature uses where present PVC and polyethylenes fail and where Teflon, Kel-F and silicone rubbers are too costly.

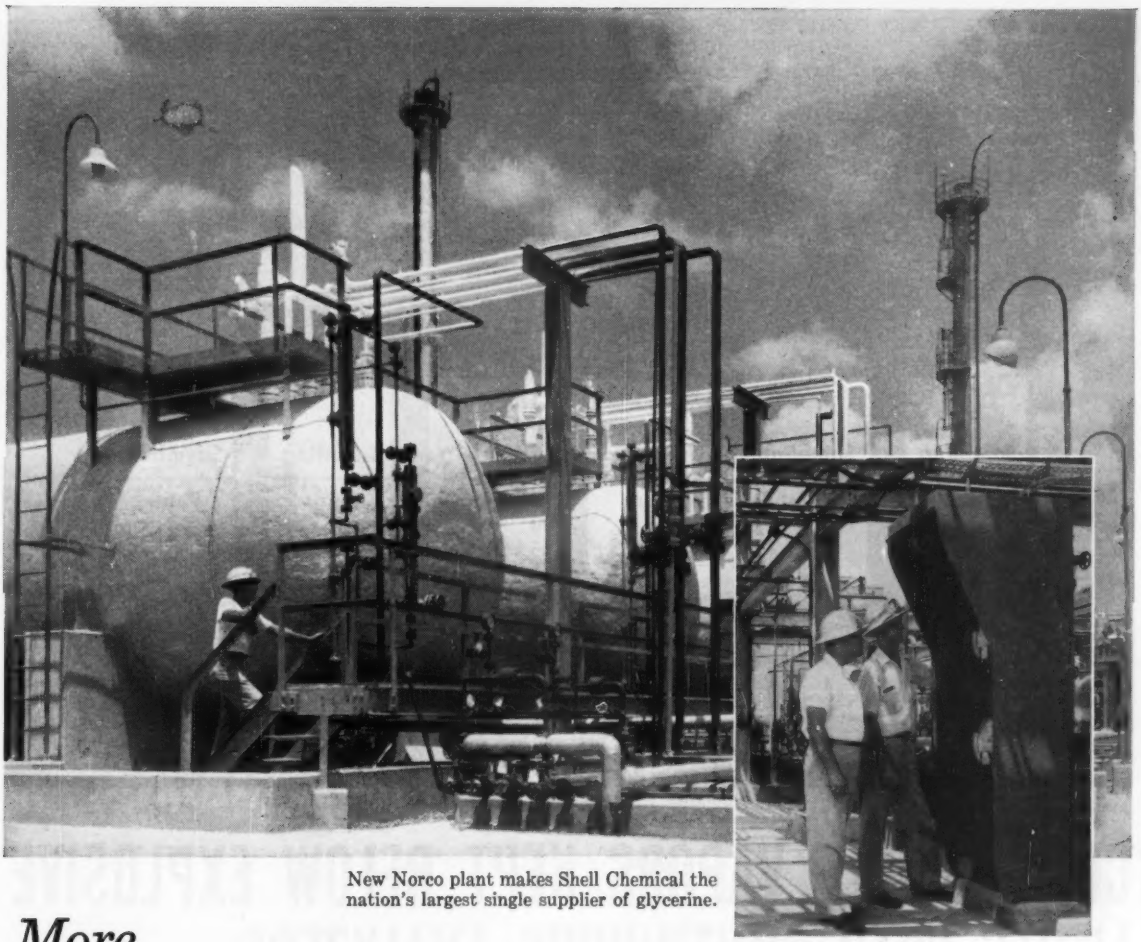
Specially-compounded polyvinyl chloride had been thought to offer greatest potential for these applications and covey of chemical and rubber companies were well along on development work. One, in fact, (Electronic Rubber Co., Stamford, Conn.) announced only last month that it was ready to sell its new high-temperature vinyl.

But Sequoia claims that its product, called "90-H," has physical and electrical properties superior to any insulation now sold. And it expects to sell over 10 million ft. this year—at about half the price of Teflon-insulated wire.

Details of the basic plastic used and processing steps are under wraps for now, but a terephthalate is one possibility. Sequoia takes the plastic, modifies its structure somewhat through a "simple" processing step, coats the wire by the usual extrusion process and passes the coated wire continuously through a GE 1 mev. electron beam generator with a 1 kw. beam output. This promotes linkages which better the plastic's physical and electrical properties.

Stanford Research Institute did the research on the structure modifying step, screening literally "tens of thousands" of formulations. Sequoia is patenting both process and product, hopes ultimately to license other companies to coat products tubing, pipe, molded products, etc.

For more of WHAT'S HAPPENING . . . 115



New Norco plant makes Shell Chemical the nation's largest single supplier of glycerine.

More Glycerine *on stream!*

Seven years ago, Shell Chemical startled industry with this news . . . high-purity *synthetic* glycerine, produced from petroleum, in commercial quantities!

Now . . . more good news for glycerine buyers! A new plant (Norco, Louisiana) is now on stream, adding further to the supply of uniform, high-purity glycerine.

And looking toward the future, Shell Chemical is building a plant for *an entirely new synthetic glycerine process,* using hydrogen peroxide and acrolein as raw materials.

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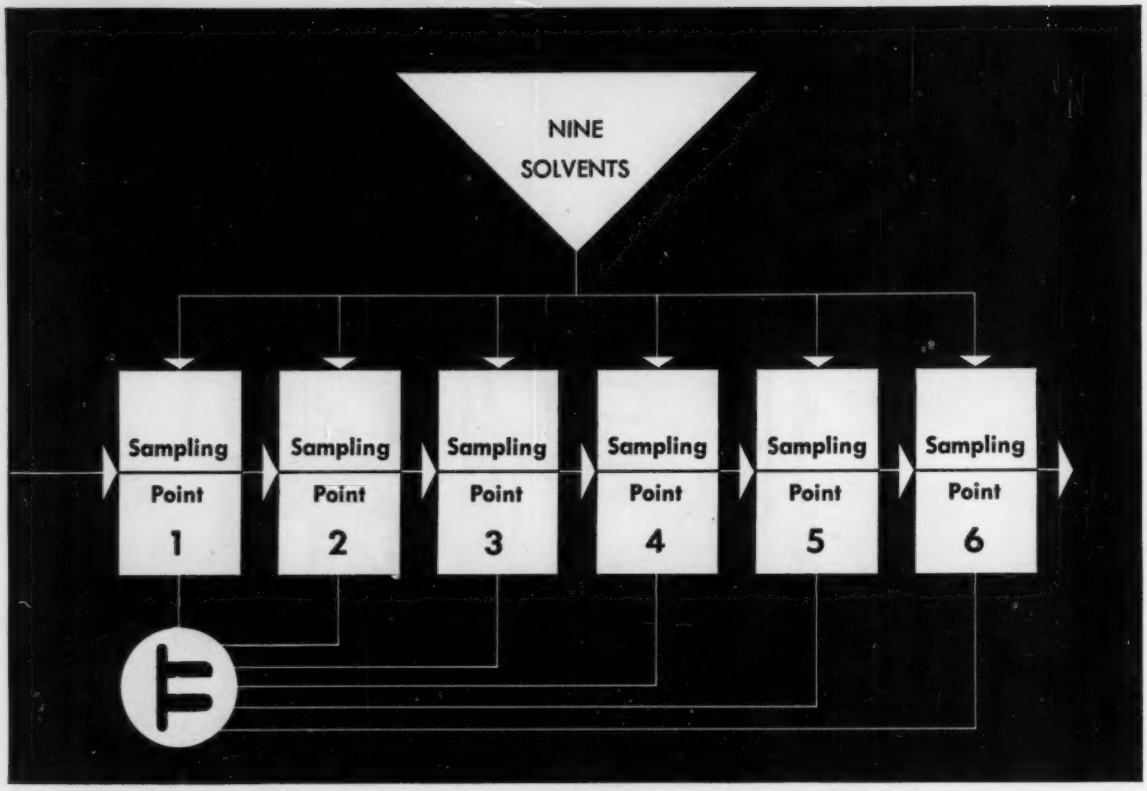

COMBUSTIBLE VAPORS KEPT BELOW EXPLOSIVE LIMITS WITH CONTINUOUS ANALYZERS . . .

Delays in detecting LEL reduced

In a process using nine solvents with lower explosive limits ranging from 1.3% to 13%, a P-E TRI-NON* Infrared Analyzer has the job of reporting vapor concentrations continuously so they can be kept below 80% of the explosive limit.

The TRI-NON analyzer is sensitized to give an equal and linear response for each of the nine solvents. This linearity allows summation of the various combinations at each station regardless of the actual vapor concentration of any one component. Only an infrared analyzer using a selective detector can be sensitized in this manner.

One TRI-NON analyzes samples from six different points in succession along the process line at a speed of 30 seconds per point. Each point is checked every 3 minutes — often enough in this particular application to detect any dangerous change in vapor concentration. (Instrument response times up to 3.4 seconds for 98% of final value are standard.) The TRI-NON is the only infrared analyzer with sufficient speed and stability to cover so many sampling points safely.

In combustible vapor analysis, whether the system contains one or a mixture of solvents, the TRI-NON provides the best zero and range stability available. It does not run into trouble when non-hydrocarbon materials are present in samples. Since it does not burn in order to analyze, deposits do not form in the detecting element and flash-back protection is unnecessary. Maintenance problems are kept to a minimum.

When you specify continuous analyzers for your process streams, P-E alone has a complete line of instruments to choose from. Or let us develop a complete analytical control system for you. Nowhere else can you get the combination of chemical engineering and instrument know-how that you'll find at P-E.

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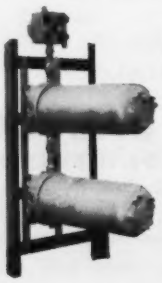


P-E TRI-NON Analyzers are available in a wide range of models and prices to meet all types of continuous analytical problems. They are rugged and dependable, expressly designed for use in the varied environments of a processing plant or refinery. For quick and easy maintenance, instrument components can be tested right on stream — without disconnecting.

What's Happening

FEBRUARY 1956 FEATURE NEWS

- **Fluid-Bed Unit Cuts Short Circuits** 116
  New low-head, crossflow design overcomes the single-stage limitation inherent in conventional upflow and downflow fluidization processes.

- **Target: Standardized Pumps** 118
  Estimated savings to the chemical industry alone amount to $6.8 million annually.

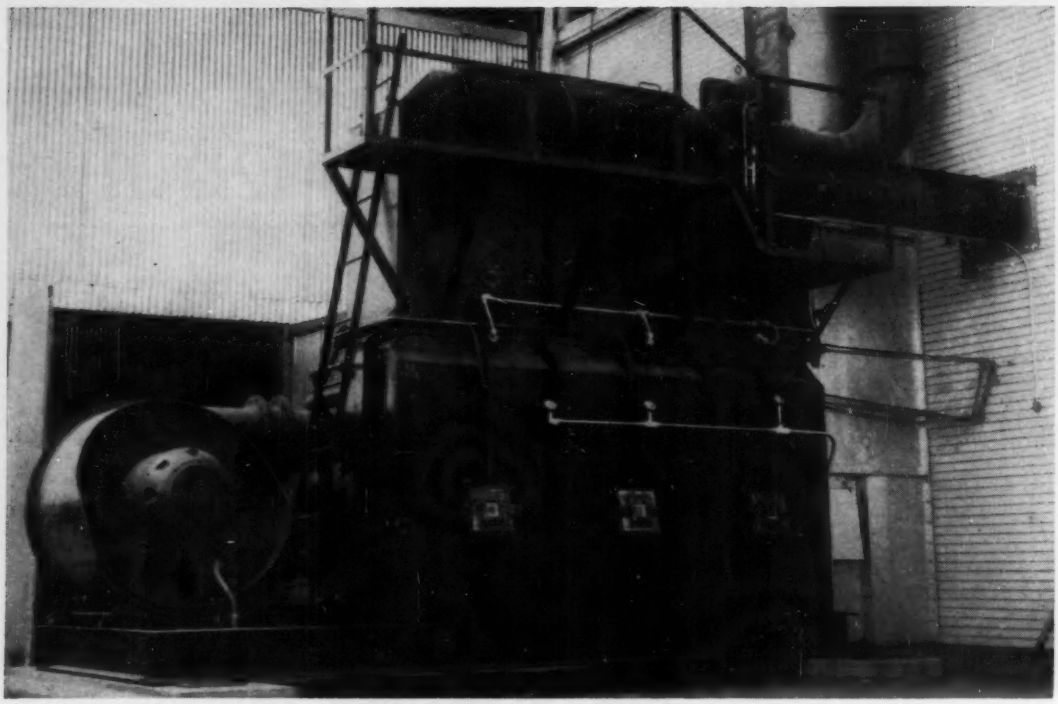
- **High-Purity Oxygen Heads for Big Volume** 122
  Brassert process for making steel is putting 99.5% oxygen on a tonnage basis. Large oxygen plants can use low pressures to turn out high-purity gas.

- **Germanium Saves Power** 126
  High efficiency and small size make germanium power rectifiers a good bet to take over the field in low and medium-voltage electrochemical applications.

- **HCl Regenerates Waste Pickle Liquor** 132
  Ruthner process recovers sulfuric acid and iron oxide at low cost; steel industry will test this scheme in a jointly financed development program.

- **Helping the Big Boost in TiO_2 Capacity** 136
  New plants and expansions—some completed, some underway, some projected—promise to loosen up the very tight, booming market for titanium dioxide pigment.

- **Convention Calendar** 120



LOW SILHOUETTE features Turboflo unit, now drying and cooling volcanic cinders at El Paso, Tex.

Fluid-Bed Unit Cuts Short Circuits

New low-head, crossflow design overcomes the single-stage limitation inherent in conventional upflow and downflow fluidization processes.

With two commercial installations operating successfully and other applications in the pilot-plant stage, the Turboflo technique now challenges the dominant position of conventional fluidization processes.

Turboflo provides the chemical engineer with a way to get stagewise operation of fluid-bed systems while maintaining equipment height and investment at a minimum. Its inventor, Wolf G. Bauer, consulting engineer of Seattle, proposes use of the Turboflo technique for such operations as calcining, roasting, drying and classifying. Its principles are covered by U. S. Pat. 2,529,366.

▶ **Avoids Short-Circuiting** — In the Turboflo process, fluidization is achieved in the usual way — gases pass upwards through a bed of solids at sufficient velocity to maintain a dense-phase suspension of solids in the gas.

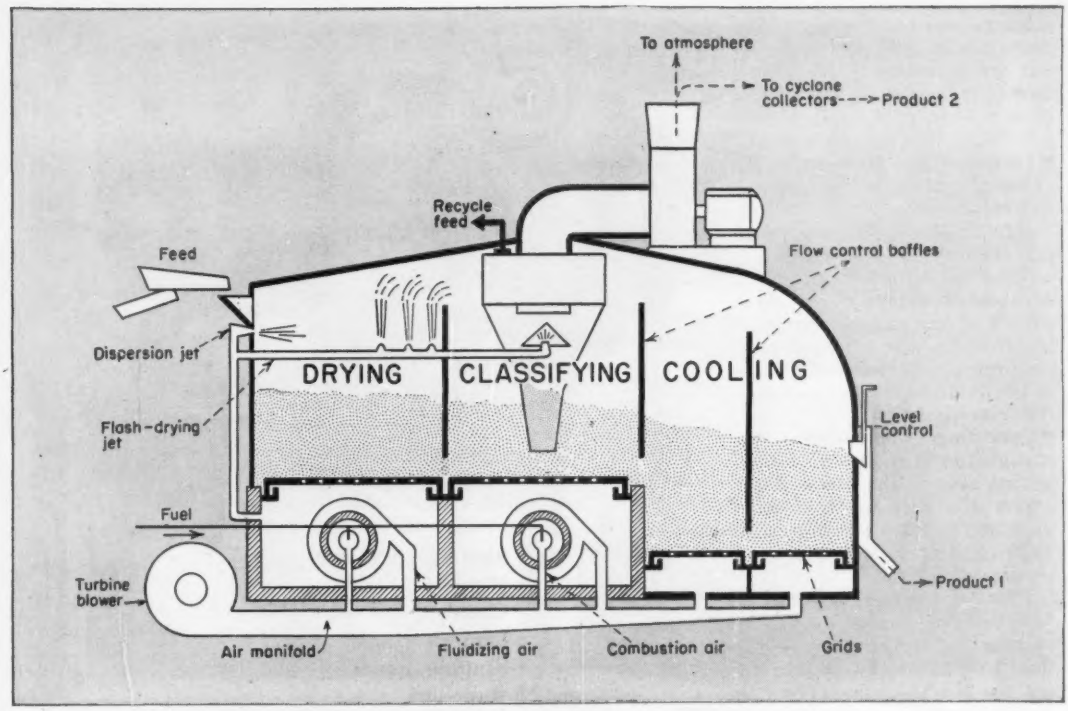
Net movement of the solids, however, is across the path of the fluidizing gases, instead of vertical, as in usual upflow or downflow fluid-bed systems.

In addition, vertical baffles divide the unit into as many processing zones as desired. For example, one zone may be used for preheating, another for drying. A classification cyclone can be installed in the next zone to separate a particular fraction of the solids. Then you can have one or more cooling zones, and so forth (*see diagram*).

Since the Turboflo design minimizes short-circuiting of solid particles, high process efficiencies and good thermal control can be achieved throughout the several zones. And the entire process is carried out within one integral piece of equipment.

▶ **Operates Commercially** — Although Bauer has been working on the Turboflo concept for many years, only recently has he experienced the satisfaction of seeing his ideas reach commercial operation.

The first Turboflo unit began operation last May. It is being used by Atlas Building Products Co., El Paso, Tex., to process 10 tons per hr. of ⅜-in. volcanic cinders for use in concrete



OPTIONAL FEATURE of Turboflo units is separation of fine particles with a classifier inside the dryer proper.

masonry blocks. Proper drying of the cinders prior to ball-milling and classifying is an important phase of Atlas's operations.

A second unit started up late last year at a plant in the Pacific Northwest. It's used for drying and classifying diatomaceous earth of 35% initial moisture content.

▶ **Has Six Stages**—Atlas's Turboflo unit has three drying compartments and three cooling compartments. Forward flow through the drying zones is in one direction, while that in the cooling zones is in the opposite direction. This conveniently puts feed and discharge points at the same end of the unit.

Drying and cooling compartments are separated from one another by adjustable baffle plates suspended in the fluidized bed. The baffles prevent particle short-circuiting and promote vertical mixing of the horizontally moving fluidized stream.

Compactness is evident from these principal dimensions: 15 ft. 4 in. long, 8 ft. wide, 11 ft. 2 in. high. The low height is a particular advantage; a staged fluid-bed unit employing vertical flow would doubtless be much taller.

▶ **Progressive Drying** — Natural gas, the cheapest fuel at El Paso, fires the unit's three combustion chambers, each located directly below a drying chamber. The combustion chambers are designed for a heat release of up to 50,000 Btu./(cu. ft.)(hr.). They are lined with 4½-in. refractory insulation.

Hot gas from each combustion chamber flows up through a perforated stainless steel plate (Type 347) into the drying chamber above. Here the gas fluidizes the solid material supported on the grid.

With proper adjustment of fuel flow to each individual burner, the first drying section gets the hottest air-gas mixture. The other two drying chambers receive progressively cooler fluidizing-drying gas.

▶ **Solids Flow Control** — Movement of the solids through the drying and cooling zones is controlled by adjusting the hot gas and cold air flows. A 5,000-cfm. turbo-blower discharging at 24 oz. S.P. into a manifold above and below the combustion chambers provides combustion air as well as cooling air.

Solids enter at one end of the dryer via a screw conveyor. As the material reaches the end of the screw it is scraped over a specially designed lip into a thin, wide, sliding sheet. Entering the first drying chamber the sliding sheet meets a thin, high-velocity curtain of jetted air and disperses over the boiling bed of cinders below.

The grid in each compartment is 2 in. lower than the one in the compartment immediately preceding, providing a gradient for forward flow of the bed. This design is necessary in the Atlas unit in order to induce sufficiently rapid flow of solids through the unit.

However, in Turboflo dryers operating on higher-moisture material (Atlas's cinders contain only 6% initial moisture) the required retention time is

much greater and the successive lowering of grid sections may not be necessary; horizontal flow of solids can be established over a level grid surface with a suitable "hydraulic gradient."

▶ **Classification Included** — To separate fine particles, a classifier can be incorporated within the freeboard space of the drying chamber (*see diagram*).

This arrangement affords a greater opportunity for flash drying of fine particles by causing them to take a longer path and repeatedly recycling them to the fluidized bed in a more-or-less closed circuit.

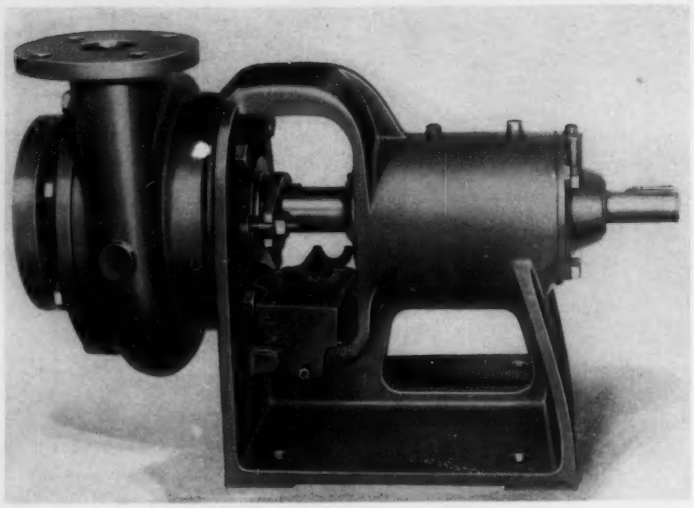
▶ **Operating Flexibility** — Although the Turboflo can be operated around the clock, Atlas starts its unit up cold each morning. It takes only 5-10 min. to bring it up to operating temperatures.

Rate of production—now 10 tons per hr.—can be boosted by raising the temperature of the fluidizing gases and by increasing the bed depth in the cooling compartments.

▶ **Good Heat Use**—In operation the Turboflo dryer has racked up good thermal efficiencies. According to Bauer, these are the key design features:

- Recuperative shell cooling of the close-coupled furnace chambers and use of insulating refractory linings throughout the heat-generation areas minimize radiant heat losses.
- Fast heat transfer between gas and solids gives almost instantaneous temperature drop of the gas in the drying compartments. A 1,000-F. differential in gas temperature can be established within 1 in., vertically, from the dryer grids.
- Finish-drying is accomplished in the cooling sections, requires no fuel consumption.
- Successive stage control of heat and gas flow along the path of solids flow minimizes variations in retention time of individual particles.

Adding these features to those which are inherently characteristic of fluid-bed systems, Bauer expects his Turboflo design to find many applications for scrubbing, dedusting, heating, gasifying, drying, calcining, cooling and classifying in a single, compact, stationary unit.



- **Shafts and sleeves**
- **Bearing brackets**
- **Glands**
- **Lantern rings**
- **Stuffing boxes**
- **Impellers**
- **Casings**

Target: Standardized Pumps

Aiming at an estimated $6.8 million annual savings to the chemical industry alone, chemical engineers are getting behind a program for standardization of centrifugal pumps.

And the program's getting serious consideration from pump manufacturers, too. This was evident at a symposium on standardization of centrifugal chemical pumps conducted at the recent annual meeting of the American Institute of Chemical Engineers at Detroit.

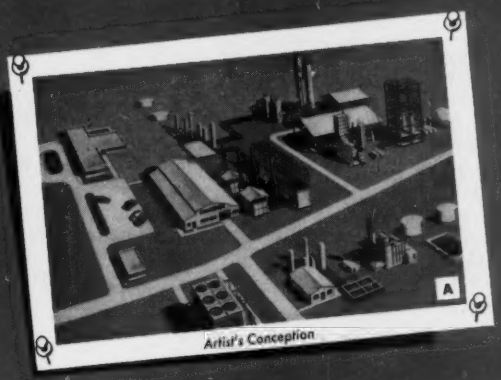
▶ **Here's the Problem**—According to D. C. Brand of Monsanto, annual replacement and maintenance costs for centrifugal pumps in the chemical industry average about 50% of initial investment. This figure is based on estimates made by a subcommittee of the Chemical Industry Advisory Board of the American Standards Association.

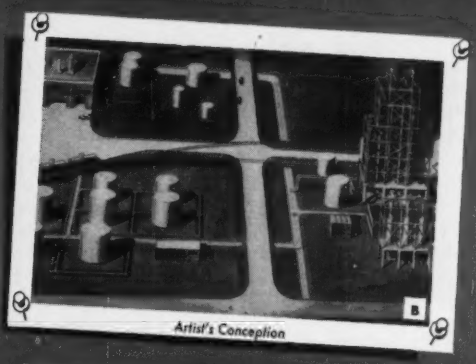
One major reason for these high costs is the lack of interchangeability among centrifugal pumps. This deficiency leads to difficult maintenance, high parts inventories and other engineering problems arising from variations in basic dimensions and features.

▶ **Here's the Answer**—As seen by the CIAB, the answer to this problem is: National standardization of centrifugal pumps.

A standardization program would establish definitions of quality and performance ratings. And it would set a pattern of desirable design features within a standard dimensional framework to allow interchangeability among various manufacturers' comparably rated pumps.

Such a program, if carried through successfully to widespread adoption of its recommendations, would lower replacement and maintenance costs, capital investment, design time, construction labor and storeroom space. (*Cont'd*)





CURRENT CHEMICAL PROJECTS

Shown above are just a few of the current Lummus chemical projects.

A Lummus-designed anhydrous ammonia, sulfuric acid and ammonium sulfate plant under construction for Gonzalez Chemical Industries, Inc., at Guanica, Puerto Rico.

B 30,000,000 lb/yr vinyl acetate plant engineered and constructed by Lummus for Air Reduction Chemical Company to come on stream at Calvert City in early 1956.

C First commercial installation in this country for manufacture of high pressure acetylene derivatives engineered and constructed by Lummus for General Aniline & Film Corporation to begin operations at Calvert City in late 1955.

D Phenol-Acetone plant designed, engineered and constructed for Progil-Electrochimie at Pont de Claix, France in 1955.

Think of Lummus when planning your next plant.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N. Y. ***Engineering & Sales Offices:*** New York, Houston, Montreal, London, Paris, The Hague, Bombay. ***Sales Offices:*** Chicago, Caracas. ***Heat Exchanger Plant:*** Honesdale, Pa. ***Fabricated Piping Plant:*** East Chicago, Indiana.

LUMMUS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

OTHER CURRENT LUMMUS CHEMICAL PROJECTS

1 60-ton/day anhydrous ammonia plant being engineered and constructed for Westvaco Chemical Division, Food Machinery & Chemical Corporation.

2 Carthage Hydrocol, now owned by Stanolind Oil & Gas Co., being redesigned and reconstructed by Lummus for manufacture of synthetic fuel and chemical raw materials from natural gas.

3 Phthalic anhydride plant for Pittsburgh Coke & Chemical Company to be built at Neville Island, Pa.

4 Lummus-designed ammonia plant for St. Paul Ammonia Products, Inc., to be built at Pine Bend, Minnesota.

5 Epon Resin units for Shell Chemical Corporation at Houston, Texas.

6 Bisphenol unit for Shell Chemical Corporation at Houston, Texas.

7 Tetramer, Cumene and Phenol-Acetone units for Societe des Chimiques des Derives du Petrole at Antwerp, Belgium.

8 Sulfuric Acid plant for Inland Chemicals Canada Limited at Fort Saskatchewan, Alberta.

▶**Work Has Started** — Pump manufacturers have already made strides toward standardization, reported M. L. Murdock of Allis-Chalmers, speaking for a representative group of pump manufacturers. To date emphasis has been principally on glands, lantern rings, stuffing boxes and shaft sleeves. Impellers, casings and cover plates are being designed for maximum interchangeability among different models.

The 10th edition of "Hydraulic Institute Standards," published Oct. 1, 1955, includes definitions and nomenclature, application standards, rating standards and test codes. Now under consideration are recommended letter designations for stuffing box areas, bare pumps and baseplate-mounted pumps.

▶**We Need It**—In view of this activity on the part of the pump makers, why are chemical engineers so active in seeking additional standardization?

One graphic answer shows up in a recent survey of the pumps in just one chemical plant. Out of a total of 1,200 pumps, this plant used 400 different, noninterchangeable types and styles. Many of the pumps differed in capacity by less than 5 gpm. and in head by only a few feet. Shaft diameters varied for no apparent reason.

Much of this wide variation has developed naturally as chemical engineers over the years tried to find the best answers to specific pumping problems. Existing general designs were modified to satisfy local conditions.

However, under today's conditions of large-volume, continuous processing, downtime for pump maintenance can be quite costly. To protect against excessive outage, therefore, plant engineers have insisted on maintaining adequate inventories of spare parts. These inventories are often gigantic.

Interchangeability and dependability are thus assuming greater importance than ever before. Old-fashioned criteria for both pump performance and maintenance methods have been weighed in the balances—and found wanting.

▶**You Can Help** — If present chemical industry thinking guides the standardization program, pump makers expect to develop an upgraded line of pumps that incorporate better mechanical design.

Yet before this can take final form, divergent opinions within the industry must be resolved. Only then can there be the singleness of thought and purpose essential to such a far-reaching program.

And even after sights have been zeroed on a consolidated target, pump makers will need the chemical engineer's backing of the over-all program.

▶**Is It Possible?** — One chemical firm is already trying to develop data to help resolve divergent opinions. Evidence collected so far shows a trend among pump manufacturers to design standard bearing brackets which accommodate various volute sizes. All five manufacturers surveyed changed the size of bracket at a 4 x 3-in. volute size; three of them offered volutes to cover capacities up to 500 gpm. at 75-100 ft. head on a single bearing bracket.

Dimensions for the bearing brackets alone and for the overall external dimensions for comparably rated pumps showed surprising similarity. For a predetermined capacity and head, the pump size offered was essentially the same.

These findings indicate to Mr. Brand that dimensional standardization is feasible.

Despite evidence of this sort, however, pump makers have made little progress towards defining the quality level of centrifugal pumps or towards dimensional standardization which will permit the user to interchange pumps of comparable ratings made by different manufacturers.

▶**Where We're Headed**—Main objectives of the pump industry's efforts toward standardization, as expressed by Mr. Murdock, will be:

- Design, engineering and quality standards acceptable to consumers throughout industry.
- Interchangeability of liquid ends between frame-mounted and close-coupled constructions.
- Quantity production of liquid ends to justify initial investments in patterns, tools and inventories of stock parts.

To design to new standards, each pump maker will have to invest something like $200,000.

Members of the original chemical industry exploratory committee look upon their work on pump standardization as only the beginning of a broad, new concept. As the fourth largest industry in the nation, and predicted to triple its size by 1970, the chemical industry can profitably undertake similar projects for general-purpose tanks, heat exchangers, agitator drives and many other types of process equipment.

Convention Calendar

Chlorine Institute, annual meeting, Hotel Commodore, New York, Jan. 25.

Canadian Pulp and Paper Assn., technical section, annual meeting, Mount Royal Hotel, Montreal, Jan. 25-27.

Association of American Soap & Glycerine Producers, annual industry convention, Waldorf-Astoria, New York, Jan. 25-27.

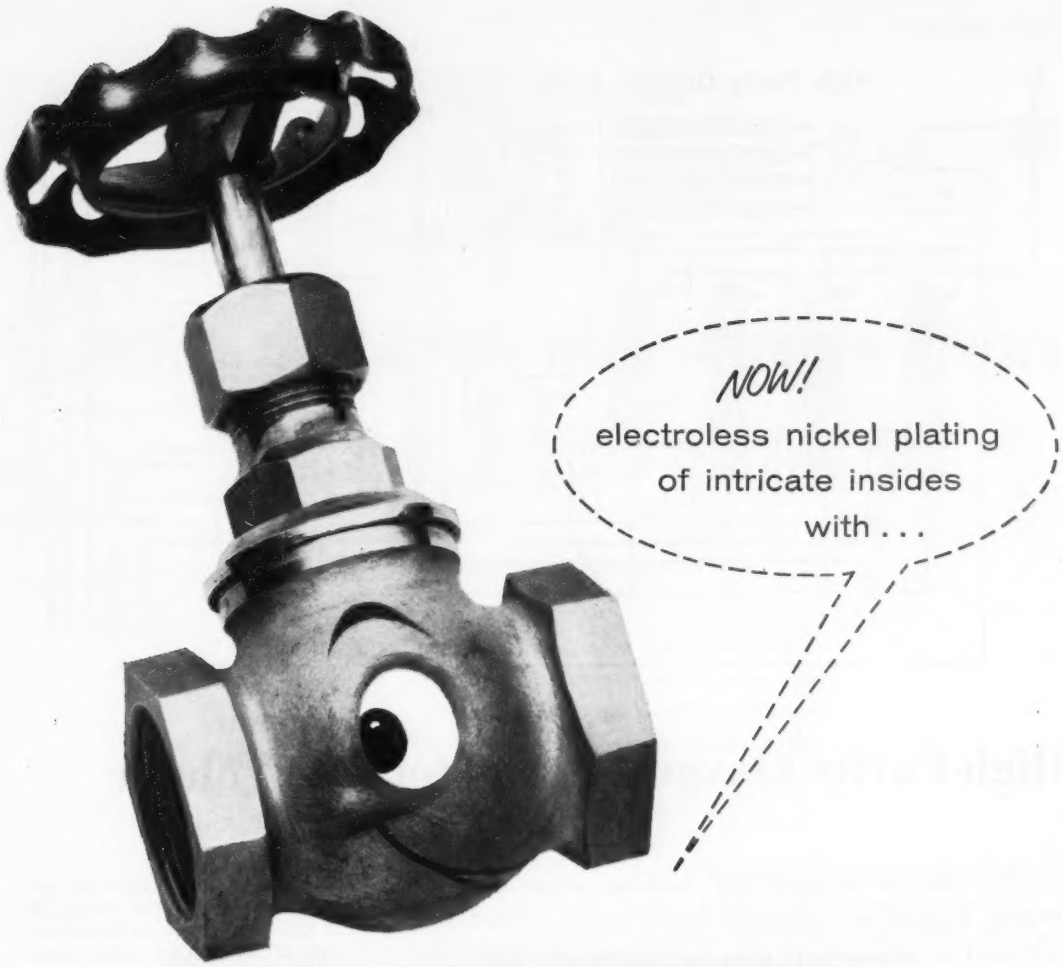
American Institute of Electrical Engineers, winter general meeting, includes sessions on electrical developments in the chemical industry, Statler Hotel, New York, Jan. 30-Feb. 3.

Chemical Market Research Association, "Aromatic Chemicals," Webster Hall, Pittsburgh, Pa., Feb. 1-2.

Society of the Plastics Industry, reinforced plastics division, eleventh annual conference, Hotel Chalfonte-Haddon Hall, Atlantic City, N. J., Feb. 7-9.

Institute of Statistics, "Statistics Short Course for Industry and Physical Sciences." Fee: $100; North Carolina State College, Raleigh, Feb. 12-18.

American Institute of Chemical Engineers, "Current Status of the Completely Automatic Process Unit" and "Air Pollution," Statler Hotel, Los Angeles, Feb. 26-29.



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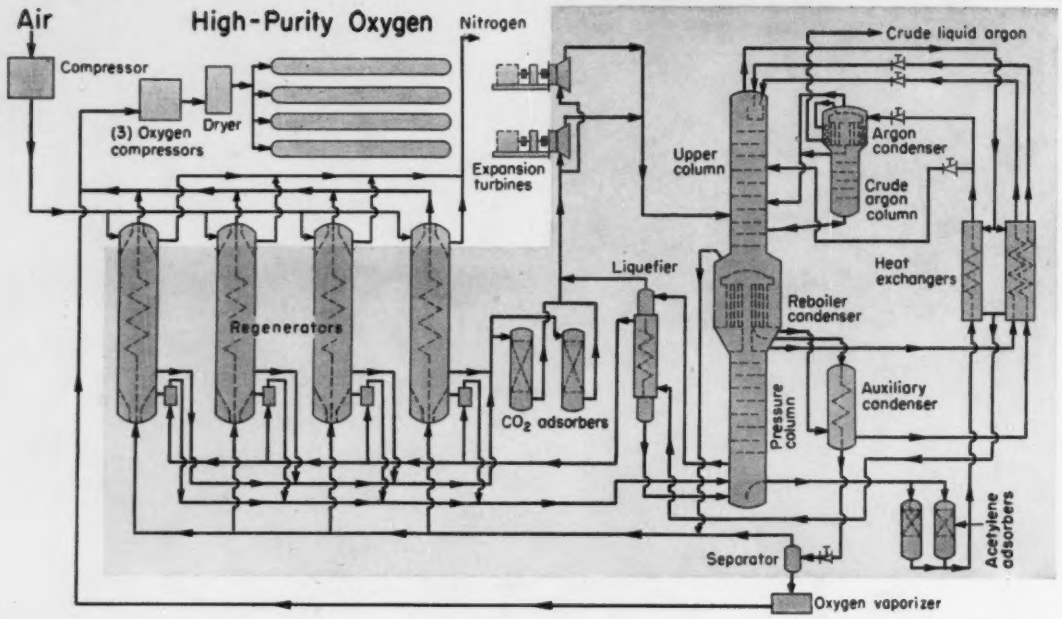

High-Purity Oxygen Heads for Big Volume

Brassert process for making steel is putting 99.5% oxygen on a tonnage basis. Large oxygen plants can use low pressures to turn out high-purity gas.

Tonnage oxygen, once touted as a comer in the chemical industry, seems destined now to play a bigger role in the steel industry.

Basis for this prediction is the definite interest steelmakers are showing in the Brassert process. This process turns out high-quality steel from a bessemer-like converter in which a jet of high-purity oxygen plays on the surface of molten iron.

First U. S. producer to use this method is McLouth Steel Corp., Trenton, Mich.; McLouth chalked up a full year's operation in December. McLouth's installation followed two earlier plants in Austria, one in Germany and one in Canada (Dominion Foundries & Steel, Hamilton).

Two more steel companies—Jones & Laughlin and Wheeling Steel—recently announced their intentions of using this process. Other firms are said to be seriously considering its advantages.

▶ **High Purity, High Tonnage**—Whereas most tonnage oxygen use in the chemical industry has been based on lower purity (95-98%), the Brassert process requires high-purity oxygen. This is because even a few percent of nitrogen adversely effects steel quality, giving rise to embrittlement.

McLouth's $2-million oxygen plant, engineered by Blaw-Knox Co., Pittsburgh, is the largest high-purity plant in the world, turns out 160 tons per day of 99.5% oxygen. It is also thought to be the first high-purity oxygen plant in the U. S. to use regenerative heat exchangers.

Another feature is provision for positive removal of traces of hydrocarbons from the system. This avoids the possibility of explosion from an accumulation of acetylene or other flammable materials.

▶ **Low Pressure** — Although high-purity oxygen plants have usually operated at pressures in the 2,500-3,000 psi. range, McLouth's air-separation process uses the low pressures commonly associated with low-purity oxygen production. Blaw-Knox cites two factors which make this possible:

- Large capacity of the unit minimizes refrigeration losses per unit of output. Until recently a high-purity plant making over 20 tons per day of oxygen was a rarity.
- Use of regenerators permits a very small approach in temperature difference between incoming air and outgoing products, again minimizing refrigeration losses.

A single steam-driven centrifugal compressor, consuming 3,000 hp., provides air to the separation plant at 82.5 psia.

Because the steelmaking process consumes oxygen at an un-

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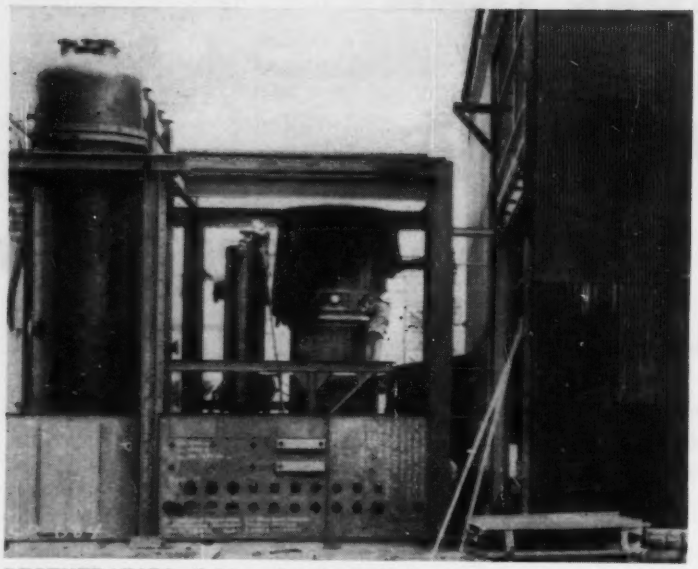
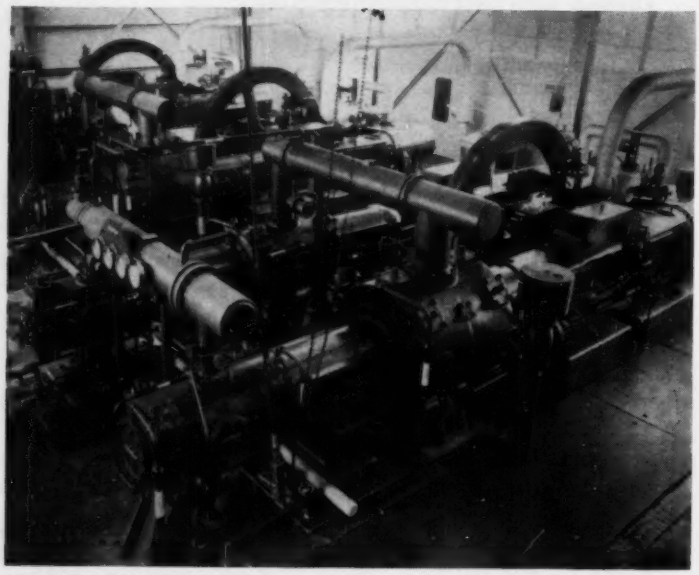


REGENERATORS (left) and column during construction of cold box.



OXYGEN COMPRESSORS pump product up to 375 psi. for surge storage.

steady rate, McLouth has to provide surge storage equivalent to 3 hr. of production. Oxygen from the separation plant, at slightly above atmospheric pressure, is compressed to 375 psi. in four-stage reciprocating machines equipped with carbon rings. There are three of these oxygen compressors (including one spare), driven by steam engines providing 475 hp. each. Water is injected into the oxygen intake line to keep the carbon rings from drying out. The 11 storage cylinders are each 8 ft. I.D. by about 70 ft. long.

Blaw-Knox won't describe the regenerators, except to state that they are packed with crushed stone and contain a tubular coil through which the oxygen stream flows. The stone, of an unidentified type, must be able to withstand cycling at low temperatures. Some idea of the size of the regenerators can be obtained from the above picture taken during construction.

▶**Low Cost**—Steel industry interest in the Brassert process is centered on its economic advantages. Compared with an open-hearth installation, the Brassert process requires only half the investment per unit of production capacity, costs less to operate and takes up much less space. Facing a pinch on capacity but reluctant to invest heavily, steelmakers hope that oxygen conversion will help solve today's dilemma.

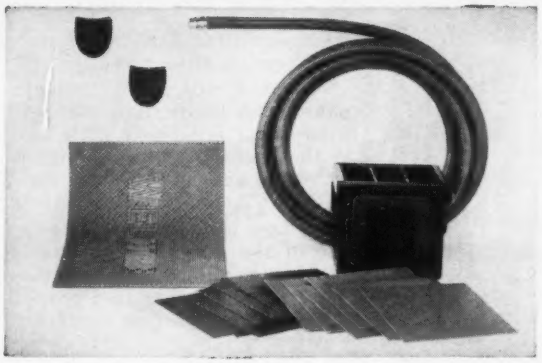
Chemical companies considering oxygen-consuming processes will find food for thought in Blaw-Knox's estimates of $5-6 per ton for oxygen cost on a 160-ton-per-day scale. These figures are based on power at 8 mills per kwh. and 15-year amortization. They exclude the cost of surge capacity and oxygen compression needed for Brassert process use. Under these conditions of intermittent demand, oxygen may cost as much as $10 per ton.

Recovery of byproduct argon can lead to still cheaper oxygen. McLouth gets a sidestream of better than 90% argon content and ships it to National Cylinder Gas at nearby Ferndale for purification and distribution. Credit for this argon amounts to a significant reduction in McLouth's oxygen cost.

Law Halts Big Canadian Hydroelectric Plan

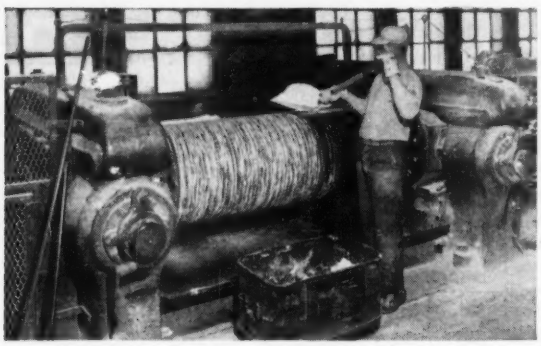
Complications caused by recent Canadian legislation controlling international river development have led Frobisher-Ventures organization to shelve temporarily its vast $700-million hydroelectric and metallurgical project straddling the British Columbia-Yukon border. Until the legalities are straightened out, the group will concentrate on an entirely new $50-million, 335,000-kw. power development on northern B. C.'s Nass River, entirely a provincial waterway.

New polymer offers rubber industry important improvements



Properties of A-C* Polyethylene – Tests in laboratories and by commercial operators show that low-molecular-weight, low-viscosity A-C Polyethylene has solved many problems in rubber processing. A-C Polyethylene, available in pellet and powder form, is easy to handle in your plant equipment. Emulsifiable grades are also available.

Shrinkage Greatly Reduced – Addition of A-C Polyethylene to milled stocks can sharply reduce shrinkage, permitting adherence to closer dimensional tolerances. In one case, shrinkage of a synthetic formulation was reduced by 75%.



Excellent Detackifying Properties—A-C Polyethylene is a superior detackifying agent, especially at elevated Banbury, mill and calender temperatures of 200°F. and higher. This property is particularly valuable when compounding synthetics. It has demonstrated exceptional qualities as a mold release; as a lubricant it allows higher operational speeds.

Compatible with Natural and Synthetic Elastomers Reports from commercial users indicate that up to 25 parts of A-C Polyethylene per 100 parts elastomer can be used with no indication of incompatibility. A-C Polyethylene-elastomer blends have possible interest where greater resistance to oils, solvents, acids and alkalies is required. It is often reported that gloss and scuff-resistance of the product are enhanced and color and filler dispersion are accelerated. A-C Polyethylene is giving the rubber industry new products and new qualities to familiar products. Try it today! Production quantities are readily available.

Information and Samples Available—Preliminary technical data is available in an eight-page brochure. Samples of A-C Polyethylene are also yours for the asking.

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COMPACT rectifier at hydrogen-oxygen plant delivers 15,000 amp. at 65v.

Germanium Saves Power

High efficiency and small size make germanium power rectifiers a good bet to take over the field in low and medium-voltage electrochemical applications.

A six-year trickling interest in germanium power rectifiers for electrochemical applications now verges on gushing. Vigorous pump-primer has been General Electric Co. which, at West Lynn, Mass., manufactures complete units ready for installation, as well as the basic germanium diodes.

Dominating the sales picture thus far, GE reports actual installed capacity at 13,114 kw., most of it in continuous production-line operation. There are about 25 installations. At least 10 more on order for use in the chemical, aluminum, steel and titanium industries will shortly bring total kilowatts to about 23,000. Largest unit on order is for 5,850 kw. (65v., 90,000 amp.) to be used on an experimental aluminum potline.

In rapid succession, such manufacturers as A. O. Smith Corp., Rapid Electric Co. and Bart-Messing Corp. recently declared their entry into the field. Source of germanium elements for their rectifier installations is International Rectifier Co. of El Segundo, Calif., at present the only manufacturer besides GE. This situation is not likely to last much longer. For example, Westinghouse Electric Co. acknowledges that they are making industry-type germanium rectifiers.

▶ **Naturally Endowed Heir**—Today's activity reflects growing certainty that the germanium unit's advantages are bound to make it natural heir to a good slice of electrochemical markets in applications where low and medium voltages can be used. Already competitive in price with other rectifiers for voltages up to 150, germanium rectifiers offer these attractive benefits:

• High efficiency — Conversion efficiency of the basic germanium junction is almost perfect at 98 to 99%; for complete power supplies, over-all efficiency is as high as 95% at 75v. d.c., 90% at voltages as low as 12. In contrast, top efficiency for selenium rectifiers, commonly used for low-voltage applications, is around 85%.

• Small size — For equal power, the lightweight germanium units occupy as little as $\frac{1}{10}$ the space of selenium units, $\frac{1}{4}$ the space of mercury-arc units.

• Low maintenance—Aging, one of the greatest drawbacks to other metallic types of rectifiers, does not occur in a properly made germanium rectifier. Furthermore, moving parts such as vacuum pumps (mercury-arc) and switching contactors (mechanical) are eliminated.

• Safety — Flexibility and increased safety at low voltage for a chemical cell line, where perhaps two lines are operated instead of one at higher voltage, makes germanium even more attractive. For small and medium-sized electrochemical plants, large high-amperage cells can be used because of the high efficiency which germanium rectifiers give in the low and medium voltages.

▶ **Electrochemical Inheritance**—Typical of recent installations are a 65-v., 30,000-amp. power supply for hydrogen-oxygen production at GE's own Pittsfield, Mass., plant (*see cut, above*); a 65-v., 12,000-amp. installation at the Allegheny-Ludlum Steel Co., also for hydrogen-oxygen production; a 24-v., 20,000-amp. germanium power supply for anodizing at Reynolds Metals Co., Louisville, Ky. First major installation (150 kw.) went into service almost two years ago on a hydrogen cell line; shortly after this a detinning installation (100 kw.) went into service for Metal and Thermit Corp.

The pattern showing germanium rectifiers' rightful place in the electrochemical market has barely started to form. But there are some early guesses that selenium units may be relegated to small, low-voltage applications; that chlorine makers, for example, may find it well worth while to revise their circuits to use 250-300-v. germanium

Painting, courtesy Power Magazine

New J-M Color Code

identifies metal in Spirotallic® Gaskets

Most engineers know that Spirotallic Gaskets maintain a perfect seal despite extreme fluctuation in fluid pressure and flange compression. Consequently, these gaskets are used in a wide range of service conditions which include high temperatures, elevated pressures and active corrosives. To withstand these conditions, Spirotallic Gaskets employ a variety of corrosion-resistant alloys.

Because so many of these metals look alike, only expensive tests or costly experience with the gasket could determine the gasket metal used, once its identifying tag was lost. Now the color patch on the centering guide tells the metal employed and saves time, trouble and expense. This new method of identification also makes it easier for storekeepers and mechanics who handle the gasket. In addition, it simplifies inventories.

Spirotallic Gaskets hold their seal because they are made of spirally wound interlocking plies of asbestos and spring-like metal strip. These gaskets compress easily with light bolting. For catalog PK-35A and copy of color code card write Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit, Ont.

Here are seven of the metals available and their color identifications

Zinc-coated steel—white

Type 304 Stainless—yellow

Type 316 Stainless—green

Type 347 Stainless—blue

Monel—orange

Copper—brown

Aluminum—aluminum

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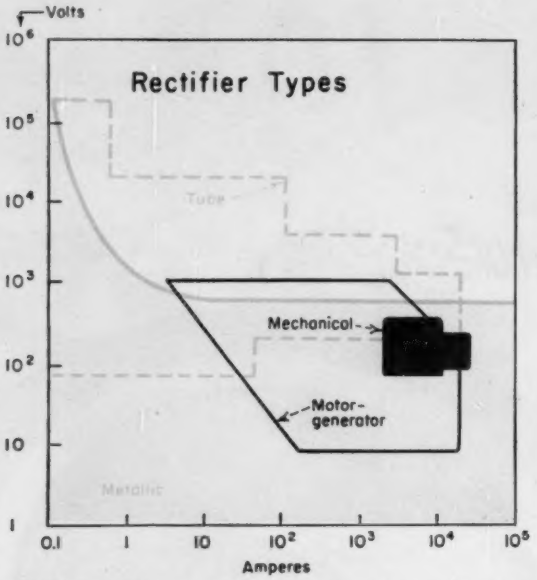


NOW SHARING traditional electrochemical markets with other metallic rectifiers, germanium may also take over some high voltage applications.

units rather than today's 600-v. mercury-arc units.

Germanium rectifiers admittedly have limitations. Most obvious and permanent is the inherent inability of germanium to stand temperatures exceeding 75 C. However, for most industrial applications this is irrelevant because few, if any, plants find it practical to operate at ambients higher than 45 C. Furthermore, unlike other metallic rectifiers, engineers know why and how a germanium rectifier rectifies. This means that performance can be predicted accurately; the rectifier equipment can be designed around the problems of a given set of conditions so that its advantages come to the fore.

▶ **Adaptable to Future Demands** —The germanium junction, or cell, itself consists of a ½-in.-dia., 0.025-in.-thick pure germanium crystal (which is grown in a long cigar-shaped configuration and sliced into these wafers) into which indium has been diffused on one side, antimony on the other. Because it is extremely small and has low thermal mass, additional radiating surface must be added to remove heat. For higher ratings the cells are on brackets and carry radiating fins. Several such cells can be stacked to provide usual circuit configurations and ratings. At present about five individual cells can be connected in parallel or in series. The figure can be raised to 10-15 within a year or so, according to one manufacturer. However, there is a general feeling that even this is a temporary goal rather than a permanent restriction.

The units are either liquid cooled (GE often uses perchlorethylene) or air cooled; the former allows higher current rating, lower noise level and greater overload capacity.

The collection of cells, a self-contained power supply, can be connected from separate secondaries on the transformer in series or parallel with other equivalent units to form almost any combination and rating of power supplies required for industry.

Single germanium junctions available today are rated as high as 66-75v., three times as high as selenium. For the future (though not within the next year), there is talk of 150-250-v., high-current-carrying germanium junctions. In the near future, germanium rectifiers are expected to move easily into 200-300-v. applications.

More Cement; Less Cement Dust

In Cape Girardeau, Mo., Marquette Cement Mfg. Co. is adding a $7 million cement plant to its existing facilities. And at Riverside, Calif., Riverside Cement Co. has started work on a $1.5 million project to reduce its plant dust by 50%.

The Marquette addition will total 1.25 million barrels per year, bringing total production at the site to 3 million barrels. It will be completed late in 1956.

At Riverside, three waste-heat boilers will be installed to cool 1,450 F. waste gases from the kilns to 600 F., the temperature needed for efficient processing through the electric dust precipitators. Cooling by the new boilers will be 100% effective. This contrasts with present operations whereby two-thirds of the gases are cooled by the boilers, and the rest is tempered with ambient air which increases the moisture content of gases, reduces efficiency of dust-removal equipment.

Steam byproduct will generate power for plant operation. Project is scheduled for completion by mid-1956.

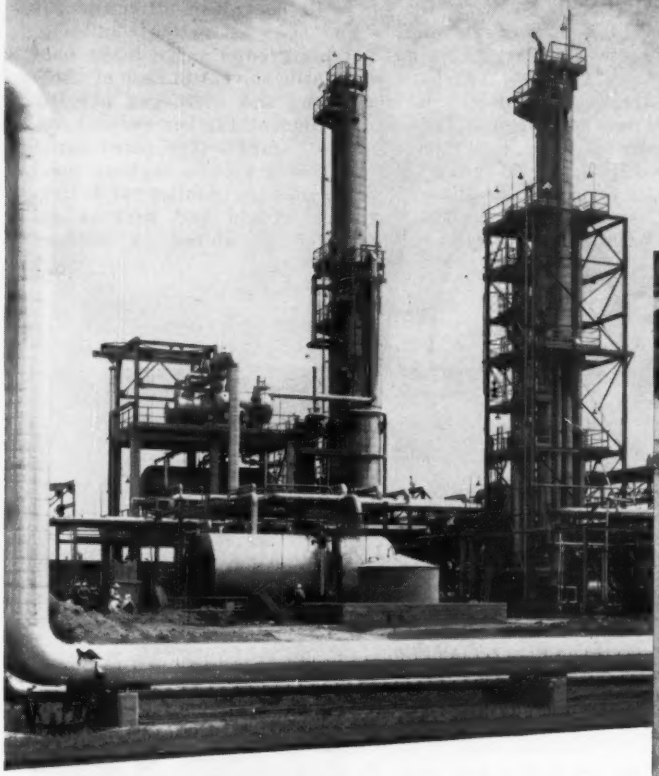
GE, Carbide Add Chips To Their Atomic Piles

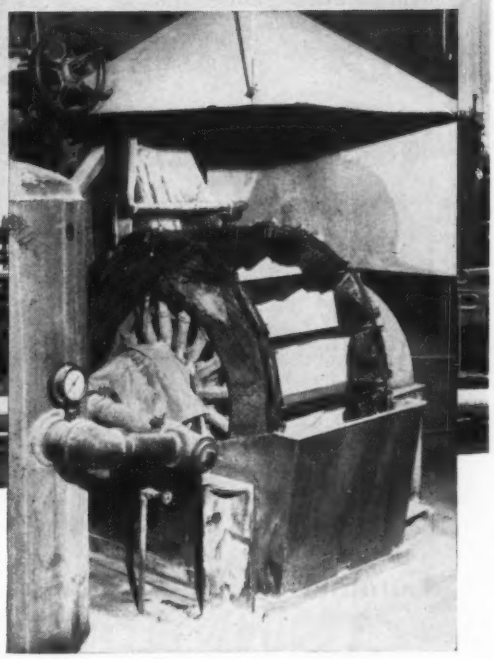
Both Union Carbide and Carbon Corp. and General Electric Co., already well into the atomic energy field, got in a bit further in recent weeks.

Carbide announced the extension to June 30, 1960, of its contract with AEC for operation of four major facilities: the gaseous diffusion and Y-12 plants and National Laboratory, all at Oak Ridge, and the gaseous diffusion plant at Paducah, Ky. No further changes were made in the contract which was due to expire in June 1957.

GE has opened a new $1.5 million laboratory at the Hanford atomic plant to seek water treatment methods that will permit greater production of fissionable material. In the past, as reactor power increased, corrosion of reactor tubes and fuel elements also increased. GE hopes to find methods for de-

PROCESSING FOR PROFIT





. . . with CB&I equipment

The chemical industry literally *"processes for profit."* And it's CB&I structures such as the stripper and absorber towers, accumulator tank and Conkey dewaterer shown above that help to make the profit.

Chicago Bridge & Iron Company has the experience, ability and facilities to design, fabricate and erect equipment to the exacting requirements that will enable you to *process at a profit.* When planning steel plate structures write our nearest office. Let CB&I provide you with the best when your requirements are the greatest.

Left Above: One 6½-ft. diam. by 73-ft. stripper tower, a 5½-ft. diam. by 88½-ft. absorber tower and a 6½-ft. diam. by 20-ft. accumulator tank fabricated and erected by CB&I at the National Petro Chemical Company, Tuscola, Ill. for the Lummus Company.

Above: Excess water is removed from washed aluminum oxide abrasive by Conkey Rotary Hopper Vacuum Dewaterer.

CB&I

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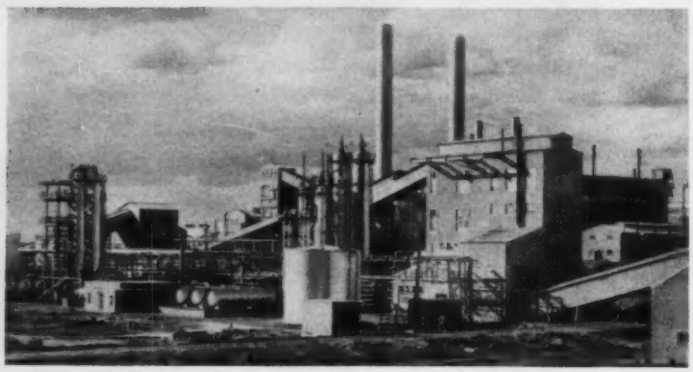
creasing this corrosion by continued improvement of cooling water treatment techniques.

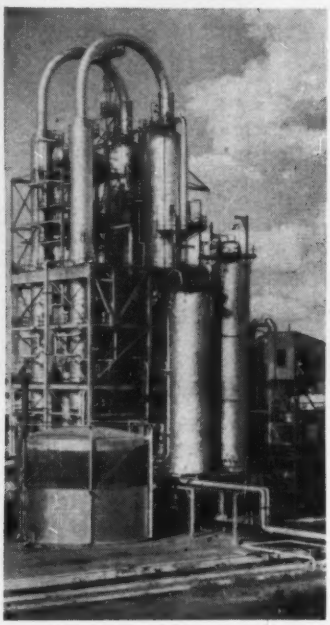
GE is also considering establishment of a nuclear-development facility near San Francisco seeking peaceful atomic energy applications. An initial project would be the support of work on a 180,000-kw., all-nuclear power plant the company expects to build for the Commonwealth Edison Co. in the Chicago area.

Soybean Processing, Modern From A to Z

An 850-ton-per-day extractor, one of the world's largest, is the heart of complete soybean processing facilities just opened in Chattanooga, Tenn., by Central Soya Co. and McMillen Feed Mills. The 26-ft. Rotocel unit puts soybean flakes through seven stages of percolation, holds 6,000 gal. of hexane solvent.

A master graphic control panel permits manual or automatic control of all equipment in the extraction building. Underground surge tanks hold volatile solvent in case of shutdown; and inert gas purging equipment further reduces vapor hazards. The plant turns out 50% protein soybean meal for use in poultry and livestock feeds and soybean oil which is stored in outdoor tanks.





FLUID-BED yields high octanes.

Commercial High Octanes From Coal

The world's first commercial plant for making high-octane gasoline from coal has started up near Vereenining in coal-rich, oil-poor South Africa. Representing, too, the first large-scale use of M. W. Kellogg's fluidized-bed version of the Fischer-Tropsch process, the plant is owned by the South African government's SASOL organization, bent on freeing the country from dependence on foreign petroleum. The plant will produce 55 million gal. per year, one-sixth of the country's gasoline requirements.

Justification for the $90 million spent on the over-all project rests on economic as well as strategic grounds. From thick seams of coal at shallow depths located 1½ miles away, raw material can be delivered to the plant at a remarkably low 70¢ per ton. And Kellogg claims economic advantages for its process over other versions of Fischer-Tropsch:

- The high octane of its gasoline product.
- High over-all conversion efficiency—98% or more.
- Lower initial investment.

The Kellogg process uses powdered iron catalyst which, after separation from reaction products, is recycled to the fluidizers. Catalysis products are recovered, separated and purified by conventional oil refining techniques. Interestingly, light hydrocarbons recovered are in so little demand in South Africa that they're reformed to carbon monoxide and hydrogen (with steam and a nickel catalyst), then recycled to the fluid unit.

Besides the Kellogg fluidized-bed reactor, a fixed-bed unit—the new German Arge version of Fischer-Tropsch—has been installed at SASOL. However, its main product is high-boiling wax for export. Because high-octane gasoline is South Africa's main concern, the Arge unit hasn't yet been started up. Both the fluidized and fixed-bed processes give diesel oil as a minor product.

High-purity oxygen is made in six Linde units—1,800 tons per day total. At full production, 3,200 tons of coal will be gasified daily in eight Lurgi units to give 4.25 million cu. ft. per hour of purified synthesis gas. Alcohols, ketones, aldehydes and acids are plant by-products which will be consumed domestically.

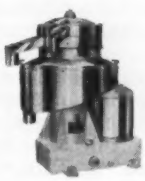
Is lack of power

limiting centrifuge performance?

. . . then the Sharples DH-3 Nozljector is the centrifuge for your plant. The DH-3 is built for the toughest concentration and clarification jobs. Sharples first built a larger bowl for maximum efficient throughput, and then designed a special rugged spur gear drive to deliver up to 40 HP necessary to achieve peak performance under any operating conditions.

The DH-3 puts *more* horsepower, and *all* the horsepower where it belongs —into the centrifuge bowl. The result is greatly increased throughput and a consistently better job of clarifying or concentrating.

We'll be glad to show you the facts on your own material. A copy of Bulletin 1276 will be sent if you just drop us a line.



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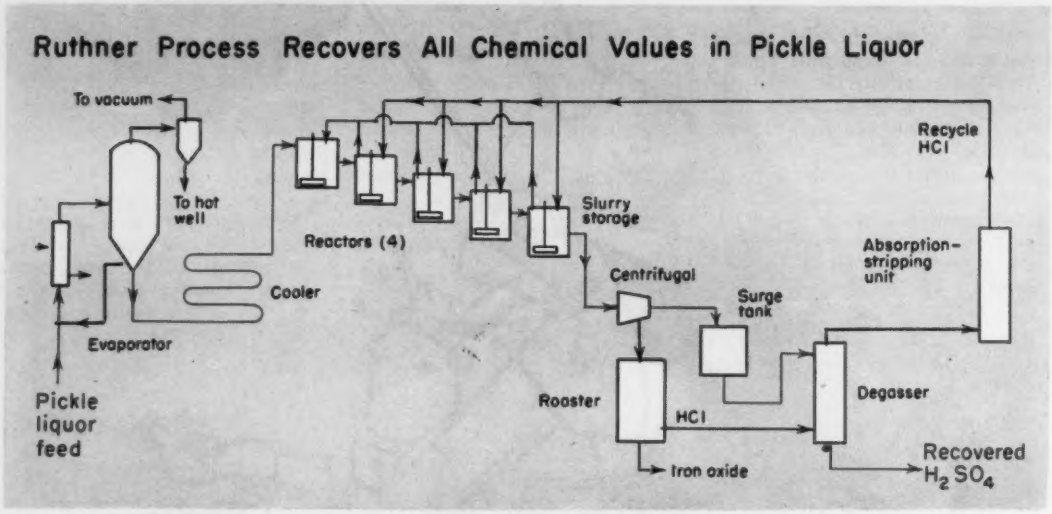


HCl Regenerates Waste Pickle Liquor

Ruthner process recovers sulfuric acid and iron oxide at low cost; steel industry will test this scheme in a jointly financed development program.

One of the steel industry's most vexing problems—economical disposal of waste pickle liquor—may be solved before long if a new chemical recovery process pans out. If successful, the process will convert a heavy liability into a valuable asset.

Seven major steel companies* are sharing in a $400,000 development program to give the process a thorough trial. They joined hands late last year with Blaw-Knox Co., Pittsburgh, to finance the erection and operation of a demonstration recovery plant at Republic Steel Corp.'s Niles, Ohio, mill.

Blaw-Knox's Chemical Plants Div. is designing, building and operating the new pilot plant. The process has already undergone extensive engineering development by Blaw-Knox.

▶**Process Benefits**—The Blaw-Knox-Ruthner process, as it is called, offers these advantages over alternative methods of pickle liquor disposal:

- All the sulfate equivalent of the waste liquor is recovered as reusable sulfuric acid without requiring a contact or chamber sulfuric acid unit.
- Only byproduct is iron oxide, which can be sintered and recharged to the blast furnace. It may possibly find use also as a pigment or for making powdered iron.
- Since substantially all acid in the waste liquor is recovered, steel producers can economically realize the inherent advantages of high-acid pickling.
- Recovery of a portion of the inhibitors used in the pickling process reduces consumption of these materials.

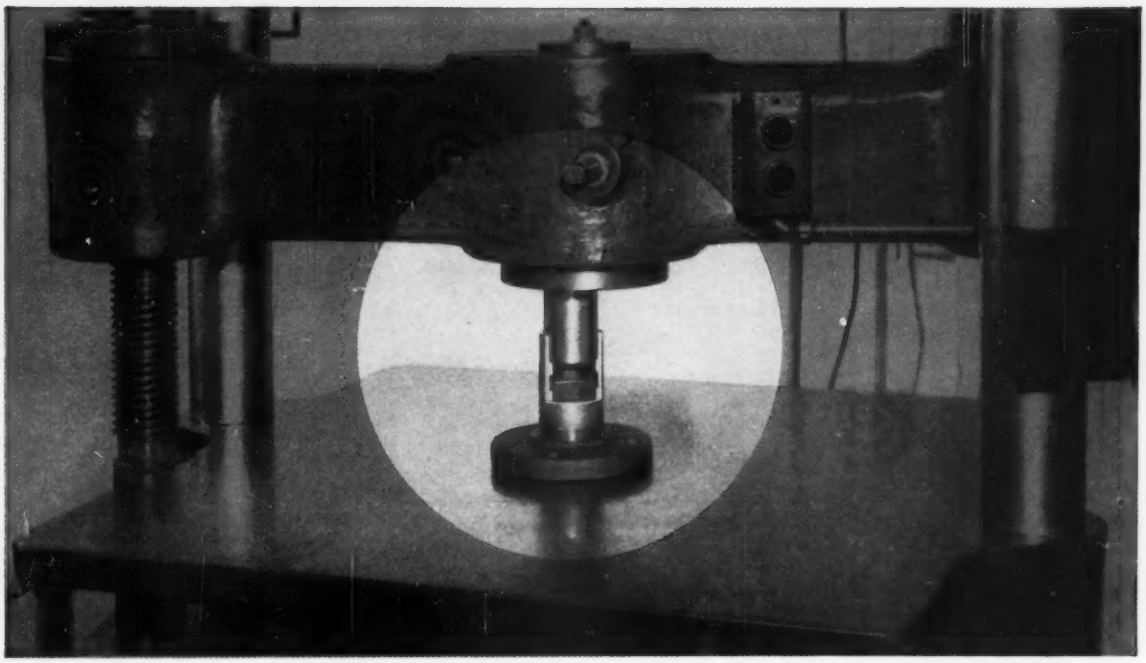
▶**Process Chemistry** — Waste pickle liquor ordinarily contains 14-18% ferrous sulfate and 2-5% sulfuric acid, the concentrations depending on the particular method used for pickling. In the Ruthner process the ferrous sulfate is converted to ferrous chloride and sulfuric acid by reacting it with HCl. The $FeCl_2$ precipitate is removed from the acid, and the regenerated acid is degassed and returned to the pickling line.

Ferrous chloride is roasted to produce hydrogen chloride gas, used in the first reaction step, and byproduct iron oxide. The only HCl required is to make up for the incidental losses. Make-up sulfuric acid is necessary only to the extent of incidental losses and the loss in the pickling line's rinse water that never reaches the recovery plant.

▶**Process Engineering** — In Blaw-Knox's concept of a commercial plant, (*see flowsheet*), the waste pickle liquor is first concentrated to 50% H_2SO_4 in a forced-circulation evaporator operating at about 50 mm. Hg. Temperature of operation is low enough (155 F.) to permit using rubber lining in the evaporator body. The external calandria uses impervious graphite tubes.

Cooled concentrated liquor reacts with HCl gas in a cascade series of four agitated reactors. Gas enters through a sparger near the bottom of each reactor. Since the reaction is exothermic,

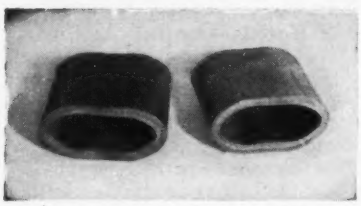
*Jones & Laughlin, Pittsburgh Steel, National Steel, United States Steel, Republic, Wheeling, and Youngstown Sheet & Tube.



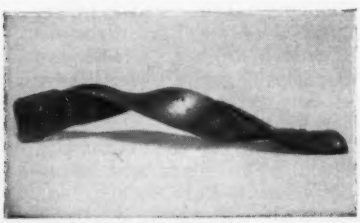
Bond holds despite shear exerted by mandrel on lead lining in test section of "Tubond" pipe.

Now...in "Tubond" pipe...a bond stronger than the tensile strength of lead

National Lead's improved bonding process inseparably weds lead to steel



Squeeze it, abuse it . . . no breaks appear in the casing, lining, or bond.



Twisted once, twisted twice . . . the second time in the reverse direction. No bond failure.

Twist it. Crush it. Manhandle it.

You just can't strip the lead lining away from National Lead's "United Tubond"® lead-lined pipe. The lining will "give" but not the bond.

Look at the test above. Here a mandrel, sized to the ID of the steel pipe minus a few thousandths, is forced through "Tubond" pipe. (A part of the side wall is cut away to show what happens.)

The lead flows, of course, and accumulates below the mandrel. But it doesn't actually pull away from the steel pipe. A thin layer of lead still remains bonded to the steel.

Now look at the twisted and crushed sections. No separation despite massive distortion. With pressure, vacuum, heat, vibration, it's the same story . . . no separation.

What weds the lead to the steel is National Lead's improved bonding process.

Proves virtually indestructible

In service, too, this bond provides an anchorage for the lining that minimizes any chance of acid leakage.

So for maximum corrosion protection, coupled with maximum mechanical strength, specify "United Tubond" pipe. Where conditions are less rigorous you may want to look into "United" expanded lead-lined pipe.

National Lead's technical specialists will be glad to help you work out the technical details of corrosion-resistant systems . . . piping, valves, pumps, coils, tanks and other elements. Just call the nearest office below.

NATIONAL LEAD COMPANY: New York 6; Atlanta; Baltimore 3; Buffalo 3; Chicago 80; Cincinnati 3; Cleveland 13; Dallas 2; Philadelphia 25; Pittsburgh 12; St. Louis 1; Boston 6 (National Lead Co. of Mass.) Los Angeles 23 (Morris P. Kirk & Son, Inc.); Toronto, Canada (Canada Metal Company, Ltd.)

Estimated Costs of Acid Recovery by Ruthner Process

Pickling process	Conventional	High-Acid	Conventional	High-Acid
Pickling capacity	A	A	2A	2A
Free acid in effluent	5.5%	25%	5.5%	25%
Acid recovered, tons/yr	10,000	23,500	20,000	47,000
Capital investment, $1,000	600	630	1,050	1,100
Fixed charges, $/week	317	333	553	580
Utilities	286	223	572	446
Raw materials	17	17	33	33
Labor	88	88	127	127
Total recovery costs, $/week	708	661	1,285	1,186
Recovery costs, $/ton acid	35.40	14.05	31.80	12.50

cooling is required. Holdup in the reactor train is about 8 hr.

Sulfuric acid-ferrous chloride slurry from the last reactor is centrifuged to separate the two products. Cake is washed with concentrated HCl, then fed to a multiple-hearth roaster, direct-fired with oil or gas, where it is converted quantitatively to hydrogen chloride and iron oxide.

Sulfuric acid filtrate from the centrifuge is still saturated with HCl. It is degassed, before reuse, by countercurrent contact in a packed tower with hot gases from the roasting furnace.

Gases leaving the tower contain all the HCl previously used in the reactors. The HCl is absorbed in 21% HCl solution; inert gases (combustion products) vent to the atmosphere through a tails scrubber. Hydrogen chloride gas for recycling to the reactors is regenerated by steam-stripping the absorber product.

▶ **Process Background** — The process originated about five years ago, the discovery of Othmar Ruthner of Vienna. Ruthner spent three years in concentrated research on the process, patented it in a number of European countries. A patent application has been filed in the U.S.; Blaw-Knox has exclusive rights to offer the process in North and South America.

Several small European units have been built, sufficient to verify the chemical feasibility of the process. The Niles demonstration plant will be small, too—650 tons per year of acid—but designed on American engineering standards. One principal difference is the substitution of direct firing for electric heating of the roaster.

▶ **Process Economics** — Estimated cost of operation depends on size of plant and free acid content of the waste liquid (*see table*). Blaw-Knox suggests that a minimum-size commercial installation would handle 10,000 tons per year of sulfuric acid. Based on a free acid content in the liquor of 5.5% and a credit of $8 per ton for iron oxide, cost of recovered acid would be $35.40 per ton. This drops to $31.80 for a plant twice that size.

While the steel industry may not get excited about these figures, with new sulfuric acid available at around $20, Blaw-Knox's trump card is the more favorable economic picture associated with use of high-acid pickling.

Output of a pickling line can be considerably increased by operating at higher acid concentrations. Chief obstacles to high-acid pickling now are the cost of the increased tonnage of acid carried away in the waste liquor and the added burden of disposal. A typical pickling operation which ordinarily would discharge 10,000 tons per year of acid at 5.5% free acid content might discharge 23,500 tons per year at 25% free acid content when operating at high acid levels.

The Ruthner process, by recovering all the acid, overcomes these objections. Since the extra ferrous sulfate load is essentially unchanged, very little extra investment is required for the additional acid load. In fact, high acid content cuts recovery costs by decreasing the load on the preconcentration evaporator.

Net result is that total cost of acid recovery for a high-acid pickling line is estimated to be less than for a conventional system. On a per ton basis, of course, the cost of acid recovery is greatly reduced—estimated at $12-14.

This is the eventual goal, then, that Blaw-Knox and the seven steel companies will be shooting for when the demonstration plant at Niles goes into operation this fall.

USI To Produce Phosphoric Acid

U. S. Industrial Chemicals Co. is adding a 60,000-ton-per-year, 75% phosphoric acid unit to its rapidly growing facilities at Tuscola, Ill. Process to be used was developed by S.A. Metallurgique de Prayon, of Belgium; raw materials are sulfuric acid and phosphate rock. To start up its new plant late in 1956, USI already produces sulfuric acid, ammonia and nitrogen solutions at Tuscola.

UK to Synthesize Rubber; US Boosts Output Again

To start making synthetic rubber in Great Britain, Dunlop Rubber Co. has announced formation of a new company, International Synthetic Rubber Co. Ltd. Initial production will be in the order of 50,000 tons of GR-S per year and should commence in 1958. The Dunlop Rubber Co. Ltd., Goodyear Tyre and Rubber Co. Ltd., Firestone Tyre and Rubber Co. Ltd. and Michelin Tyre Co. Ltd. have already agreed to invest in the new venture.

In the U.S., the Texas-U.S. Chemical Co. plans new installations at its Port Neches, Tex., plant. It will up its synthetic rubber production about 35%—to approximately 75 million lb. per year.

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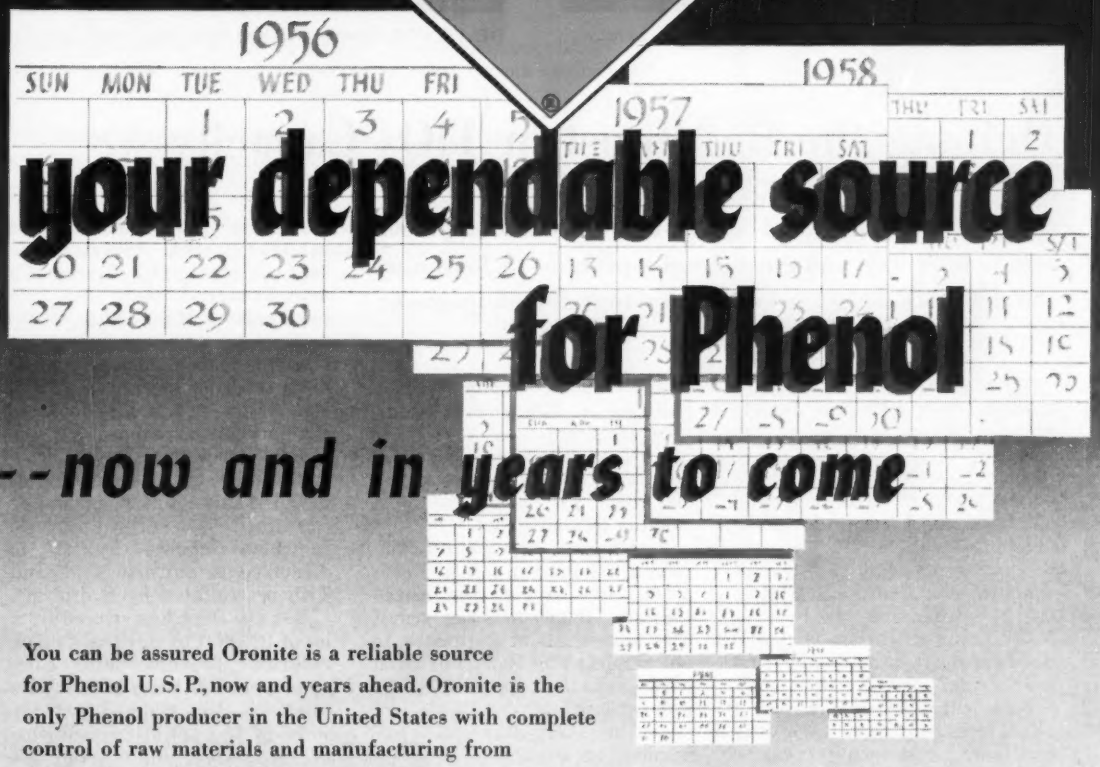

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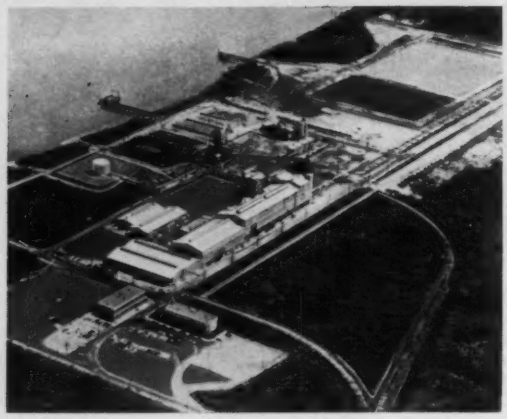
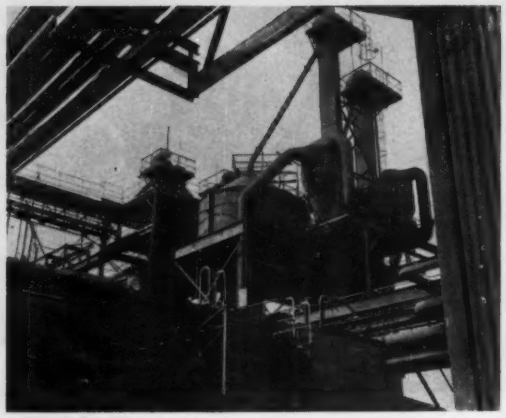


CYANAMID'S new plant at Savannah, Ga., and . . .



DU PONT'S chloride route at Edge Moor, Del., are . . .

Helping the Big Boost in TiO_2 Capacity

New plants and expansions—some completed, some under way, some projected—promise to loosen up the tight, booming market for titanium dioxide pigment.

With American Cyanamid's spanking-new titanium dioxide plant at Savannah, Ga., now on stream, the industry's spectacular TiO_2 expansion program of the past two years is around the bend and heading down the stretch.

That program is now beginning to look like a relay race, for no sooner are new production units starting up than the producers are announcing further expansions in capacity.

New capacity is coming in none too soon. Makers of the brilliant, high-opacity white pigment have been hard put to meet swelling demands from myriad users in paint, paper, rubber and other industries. By the middle of this year, however, 1955's gray market in TiO_2 should be just a bitter memory. U. S. productive capacity will be increased more than 25%, from 350,000 to 440,000 tons per year.

▶Who's Doing What—Here is the TiO_2 expansion picture as of the first of the year:

• National Lead will come on stream shortly with a new 36,000-ton-per-year unit at St. Louis. The company is also building a $15 million plant near Montreal.

• Cyanamid's new plant at Savannah has a capacity of 24,000 tons per year and cost roughly $15 million.

• Glidden expects to complete a $10 million unit at Baltimore by April (estimated capacity: 18,000 tons per year). Two more units at Baltimore, to be completed by 1960, will swell total capacity to double its present level.

• Du Pont has just announced an expansion program at its Edge Moor (Del.) and Baltimore works which will increase company's output by more than 25%—to an estimated 140,000 tons per year. First phase of this program—a 15% increase in Edge Moor capacity—is already under way and will be operating by autumn. Additional increases are scheduled for completion next year.

• New Jersey Zinc, a newcomer to the field, is taking over Cyanamid's existing 20,000-ton-per-year plant at Gloucester City, N. J., early this year. Although purchase was negotiated in 1954, actual transfer has been delayed until Cyanamid's new Savannah plant got into production. Meanwhile, Gloucester City has operated under Cyanamid management. N. J. Zinc gets a going organization, complete with trained operators and built-in know-how.

▶New Process Development—Practically all the TiO_2 produced in this country is made by the time-tested sulfate process, in which ilmenite ($FeTiO_3$) is dissolved in sulfuric acid, and TiO_2 precipitated by hydrolysis.

But Du Pont has stirred up a lot of interest by putting its new chloride process into commerical use at Edge Moor. This process, it's claimed, avoids some of the pollution problems of the sulfate route. And it's rumored that capital investment is much less than for an equivalent sulfate unit.

Du Pont isn't releasing much information on the process as yet. It's common knowledge, though, that they first make titanium tetrachloride by chlorinating ilmenite in the presence of carbon. Iron is converted to ferric chloride, while titanium goes to titanium tetrachloride. The carbon serves as a reducing agent.

After separation of ferric chloride, the liquid $TiCl_4$ is highly purified, then oxidized

FOSTER WHEELER ANNOUNCES A

COMPLETELY NEW

COOLING TOWER

...designed for FASTER ERECTION
and LONG-RANGE ECONOMY

Here are some of its outstanding new features:

Water-Mizer Drift Eliminators, assembled in racks, engineered for maximum efficiency. Drift losses held well *below* recommended minimum values.

Full Cone Spray Nozzles provide maximum dispersion with exceptionally low pressure drop. Spray pattern remains excellent for any overload and for at least 30% below design flow.

3'x6' Double Diamond Fill Racks utilize heavy stringers and 1" lath spaced in a diamond pattern, affording rigidity while minimizing pressure drop.

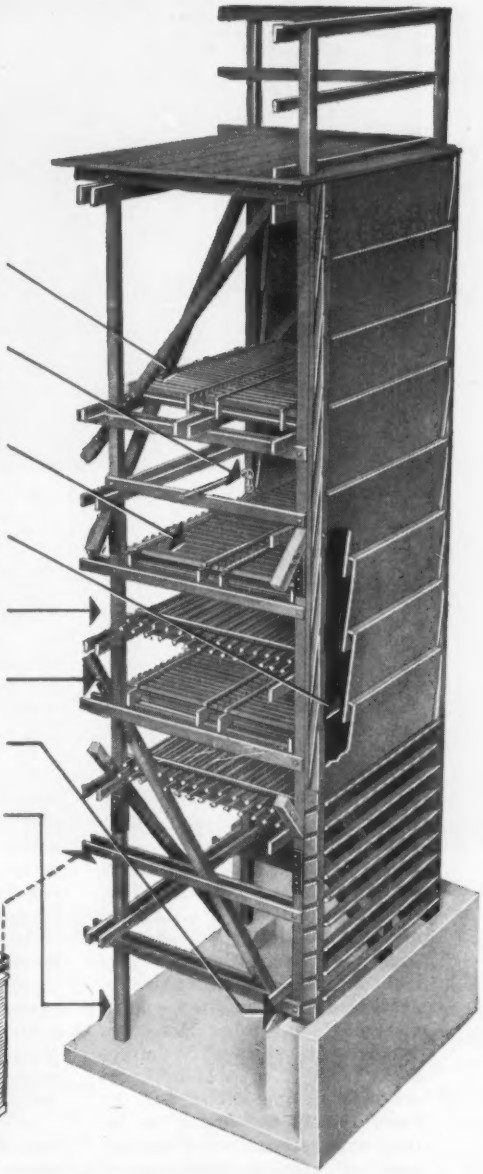
Double Lapped Sheathing Panels provide the water-tight advantage of double-wall construction yet avoid stagnant air spaces and prevent wood attack. Panels are pre-assembled to cut erection time.

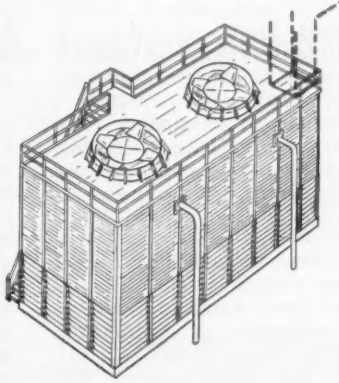
Redwood Framing, structurally redesigned to 6'x6' bays, to provide maximum rigidity and conservative loading of all members.

Simple, Straight-Line Bracing eliminates all eccentric joints and relieves structural members of horizontal shearing and bending stresses.

Simple Clevis Anchors are used on the diagonals, not the posts. Require only one foundation bolt per anchor.

Self-Leveling Interior Posts cut to fit basin floor — compensate for irregularities in level and eliminate need for pads or grouting.





Detail drawing of a single corner bay of the new Foster Wheeler Induced Draft Cooling Tower. Lower fill racks have been omitted to show structural details to better advantage.

THESE are just a few of the many advantages designed into the new Foster Wheeler Cooling Towers. Built of decay-resistant California redwood throughout, this induced-draft counter-flow tower represents an important advance in cooling tower design. Ask your FW representative to give you complete details — or send for additional information. *Foster Wheeler Corporation, 165 Broadway, N. Y. 6, N. Y.*

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NATIONAL LEAD'S Sayreville, N. J., plant uses these big rotary kilns.

with air at high temperatures to TiO_2. Chlorine, byproduct of the reaction, is recovered and reused.

▶**Lots of Potential**—The chloride process, up to now a minor factor in the over-all picture, may well loom large in future expansions in the industry. For $TiCl_4$ is also the intermediate used to make titanium metal by either magnesium reduction or sodium reduction.

Du Pont's commercialization of the chloride process for TiO_2 ties in neatly with its stake in metal production. Although present chloride-derived pigment and metal plants are separated by about ten miles (Newport and Edge Moor are on opposites sides of Wilmington) because of specific local conditions, operations will be more closely integrated in future expansions. Du Pont has just indicated its intentions of making TiO_2 pigment at the New Johnsonville, Tenn., plant site originally selected for a metal plant. Chances are good that the chloride process for pigment will be used there.

National Lead, one of the two owners of Titanium Metals Corp. of America, would also have a natural interest in the chloride process, as would New Jersey Zinc, which has been experimenting with metal-producing processes.

▶**Tried and True**—Aside from the comparatively small chloride-process unit at Edge Moor, recent expansions have stuck with the conventional sulfate process.

In this process, finely ground ilmenite reacts with concentrated sulfuric acid, forming a dry mass of iron and titanium sulfates. This is dissolved in water, with scrap iron added to convert ferric salts to soluble ferrous.

Residual insolubles are removed in thickeners, then two-thirds of the ferrous sulfate is taken out of solution by crystallization and centrifuging. Mother liquor is clarified, then concentrated in vacuum evaporators.

In the all-important hydrolysis step, concentrated mother liquor is heated to boiling, diluted with water and seeded. A precipitate of hydrous titanium dioxide forms, plus sulfuric acid. Pigment-grade TiO_2 is obtained after filtration, washing and calcining, while the sulfuric acid is recovered and reused.

▶**What About the Ore?**—With increasing production of pigment, the hunt has been on in earnest for more and better ore to feed the hungry sulfate-process plants. The only commercially important ore in the U. S. is ilmenite, which contains 45-55% TiO_2, depending on source and concentration methods. Rutile (90% TiO_2), another titanium-bearing ore, is available in very small quantities—not enough to be commercially important.

However, there is a new twist in the raw materials situation. In addition to straight ilmenite, New Jersey Zinc, Glidden and American Cyanamid will use titanium-bearing slag. This slag, containing about 70% TiO_2, is produced at Sorel, Que., by electric smelting of Canadian ilmenite. The Canadian ore is unsuitable for concentration by usual ore-dressing methods. Pig iron is a coproduct of the smelting operation.

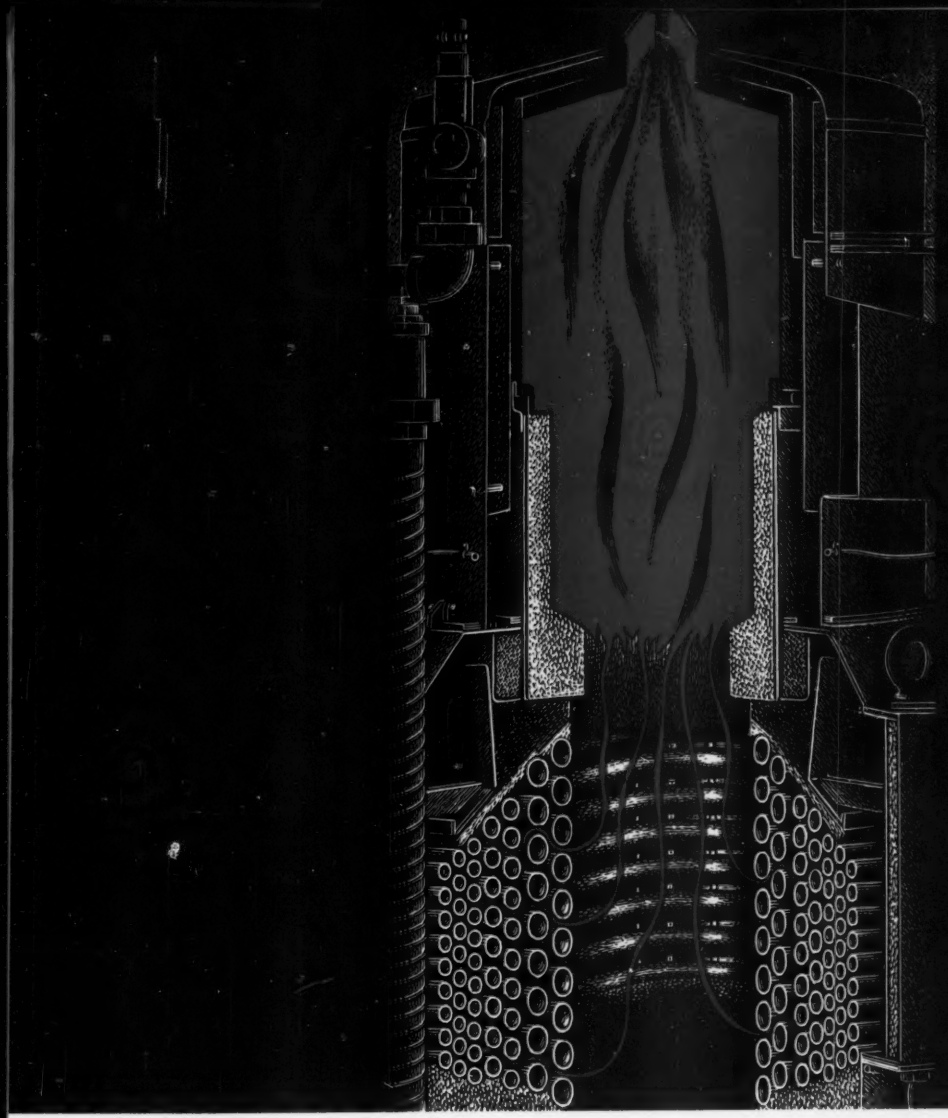
▶**More Ilmenite Coming**—Just recently National Lead found additional ore deposits at two of its existing mining locations—Tahawus, N. Y., and Sokndal, Norway. These deposits can be concentrated by standard methods.

Ore concentrates still come in from India, our major supplier before World War II. But domestic sources, particularly at Tahawus, Piney River (Va.) and the inland beach sands of Florida, together with the Canadian deposits, now supply more than 75% of the ore consumed in the U. S.

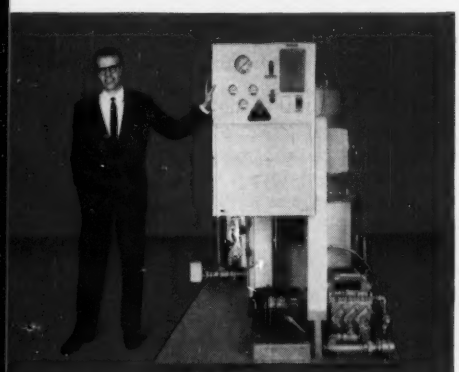
▶**Improved Hiding Power**—Raw materials, however, are only one part of the picture.

All steps in the process have come under intensive investigation, but most of the attention has been focused on the hydrolysis. For it is here that TiO_2 crystal type—either anatase or rutile—is determined. Type and size of crystals depend on concentration, temperature and the critical seeding technique. Seeding involves introducing rutile or anatase crystals during the hydrolysis; details of how and when the crystals are added are closely guarded company secrets.

All producers make both anatase and rutile TiO_2 pigments. However, National Lead is the only manufacturer still making an extended TiO_2 pig-



more steam, faster steam in less space



See how small, how compact, 100 h. p. can be!

Water, force-circulated through a Modulātic Steam Generator, absorbs heat more thoroughly because of splitting gasses into thin wiping films over many uniquely spaced heat-transfer surfaces. This unique spacing is a result of Vapor's exclusive water-tube design.

This provides more steam from much smaller boiler rooms in new plants—makes possible addition of steam in already crowded plants. The entirely self-contained, fully automatic Modulātic unit can be moved through existing doorways and installed in unused corners or other out-of-the-way spaces.

It's time to take a new look at steam-making progress—at what today's remarkable water-tube Modulātic will mean to you in new time and money economies. In Canada, write Vapor Car Heating Co. of Canada, Ltd., 65 Dalhousie St., Montreal 3.

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ment—anatase or rutile coprecipitated with barium or calcium sulfate.

▶ **Rutile Winning Out**—The superior hiding power (an indication of tinting strength) of the new, pure rutile pigments is forcing rapid obsolescence of anatase. Rutile is just about tops in hiding power:

	Hiding Power, Sq. Ft./Lb.
Rutile TiO_2	147
Anatase TiO_2	115
Zinc sulfide	58
Extended TiO_2	57
High-strength lithopone	44
Commercial lithopone	27

Anatase is still preferred in house paints requiring controlled chalking (slow flaking of paint film) for cleanup, in delustering of fibers, and in paper coating where rutile is too expensive. But it's just a question of time before rutile will completely dominate the market. Development of a chalking rutile will hasten the day.

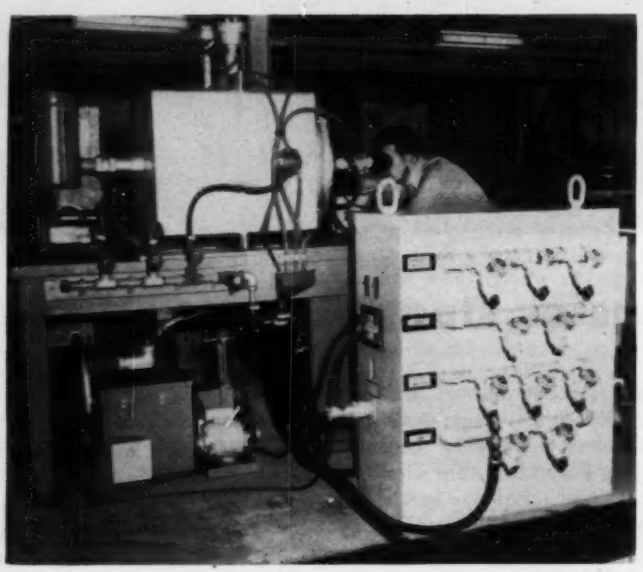
▶ **Leading Pigment**—Whether it be anatase or rutile, however, there is no doubt that titanium dioxide has become the leading pigment for a host of products which must be made whiter, brighter or more opaque. TiO_2 already has about 70% of the white pigment market.

About 67% of TiO_2 production goes into paints, enamels and lacquers, with demand being accelerated by today's trends toward lighter colors. Excellent dispersing properties have established TiO_2 as the standard in emulsion paints. Also, increased demand for one-coat paints has forced paint manufacturers to fortify their products with TiO_2 for adequate covering power. And its lasting whiteness has established TiO_2 firmly in alkyd enamels.

In paper, which takes 14%, the trend is toward lighter-grade products. This calls for more pigment to maintain opacity.

Titanium dioxide is also used in rubber and plastics (9%) for its whitening and brightening properties; in floor covering (2%) for its tinting abilities; in vitreous enamels and glass (2%) for its opacity; in fiber delustering for its fine particle size and high index of refraction.

All growing markets, these. And TiO_2 is growing right along with them.



Utility Islands Allow Full Use of Lab Floor Space

Twelve removable utility islands, lined up in two rows at 20-ft. intervals, can be adapted to service any combination or arrangement of research equipment in the high bay section of Electro Metallurgical Co.'s new chemical engineering building in Niagara Falls. Electricity, city and service water, city gas come to the island (right, foreground) in trenches with removable concrete slab covers. Island's removal leaves floor unobstructed.

News Briefs

Lithium: Lithium Corp. of America has announced immediate plans to expand its Minneapolis electrolytic plant to increase production of lithium metal and lithium hydride.

Leather: A new $2.5 million tannery just opened by A. C. Lawrence Co. in South Paris, Me., is more fully automated than any other in the country. Expected result: 10% savings on operating costs.

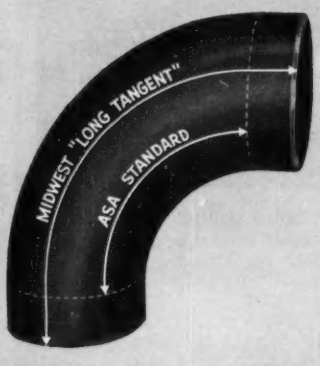
Vinyl Acetate: A $2 million addition to Du Pont's vinyl acetate plant in Niagara Falls, N. Y., is about ready to go on stream.

Carbon Black: Cabot Carbon of Canada, Ltd., Sarnia, Ont., is expanding plant facilities to boost production of oil furnace carbon blacks from 20 million to 55 million lb./yr.

Salt: Hooker Electrochemical Co. and Pennsylvania Salt Mfg. Co. have formed a jointly owned subsidiary, Chemical Salt Production Co., at Great Salt Lake, Utah, to provide their Northwestern chlorine-caustic operations with an unlimited source of industrial salt.

Resin: Plans to triple production capacity of vinyl chloride paste resin at Springfield, Mass., have been announced by Monsanto Chemical Co.'s plastics division. New facilities will be in operation by mid-1956.

THESE MIDWEST "LONG TANGENT" ELBOWS SAVED $4121 IN PIPE



MIDWEST "LONG TANGENT" ELBOWS COST NO MORE THAN OTHER ELBOWS

Here are 1227 Midwest "Long Tangent" Elbows (12", 14" and 16" standard weight) ready for shipment to a chemical plant. Each Midwest "Long Tangent" Elbow has a straight section on each end equal in length to ¼ the nominal pipe size. Thus a 12" elbow saves 6" of 12" pipe while a 16" elbow saves 8" of 16" pipe. It doesn't take long to save a lot of pipe and a lot of money . . . in this instance $4121.

But saving pipe is not the only advantage of Midwest "Long Tangent" Elbows. They often eliminate short nipples and their extra welds . . . save time and money in lining up and clamping pipe and fittings . . . slip-on flanges are more easily applied. For all the facts, write for Catalog 54.

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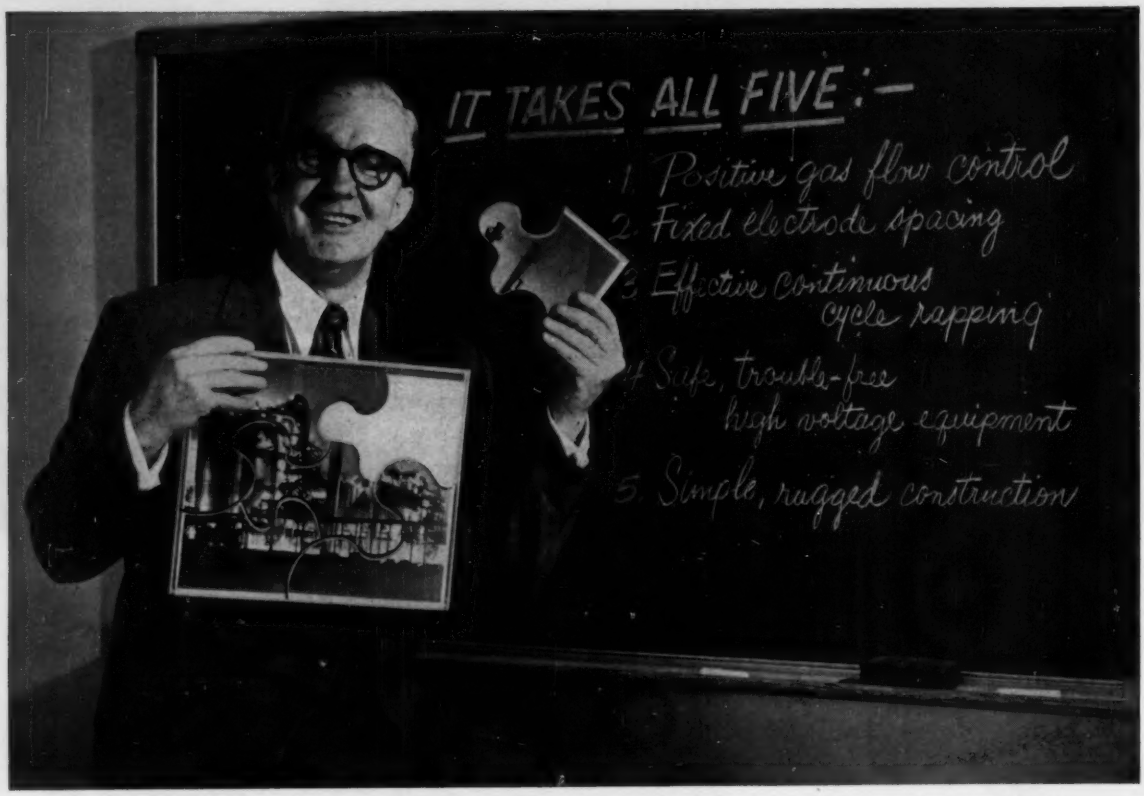
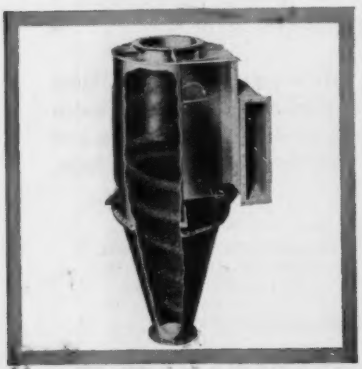
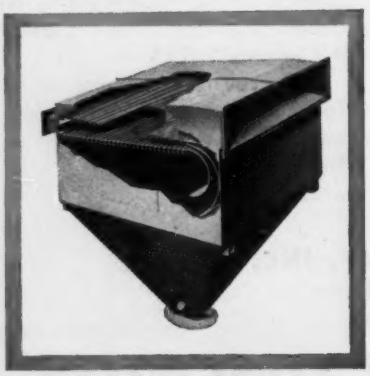
Buell 'SF' Electric Precipitators meet all 5 basic requirements for TOP EFFICIENCY


IT TAKES ALL FIVE :—
1. Positive gas flow control
2. Fixed electrode spacing
3. Effective continuous cycle rapping
4. Safe, trouble-free high voltage equipment
5. Simple, rugged construction

A slight deficiency of any single factor would be sufficient to impair the performance or service life of any dust recovery system. The constant top efficiency of Buell installations is the result of skillfully adjusting all five elements to best meet various operating conditions . . . provide consistent top efficiency.



Buell Cyclone Collectors are noted for their efficiency, too. Here are exclusive reasons why: shave-off design which harnesses back-flow and puts it to work . . . plus extra large diameter design to prevent "plugging."



Buell "LR" Fly Ash Collectors are ideal for low and high pressure boiler operations up to 2000 BHP, with either natural or mechanical draft. Check them for high efficiency, simple design, compactness, flexibility in layout.

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Experts at delivering Extra Efficiency in **DUST COLLECTION SYSTEMS**

Lapp Valves are Solid Porcelain

You need to make no compromise with contamination or corrosion from valves in chemical processing. Lapp valves are of *solid* Lapp Porcelain, a material unique as a ceramic for industrial scale chemical service. It alone offers the following combination of characteristics and qualities:

PURITY • Lapp Porcelain is a potassium aluminum silicate, made from selected clays, flint and feldspar...has no free iron or other metallic impurity.

NON-POROUS • Complete vitrification of all sections, through firing to 2300°F., provides *zero* porosity. No dye penetration of body in 100,000 psi test. No chemical can penetrate in service.

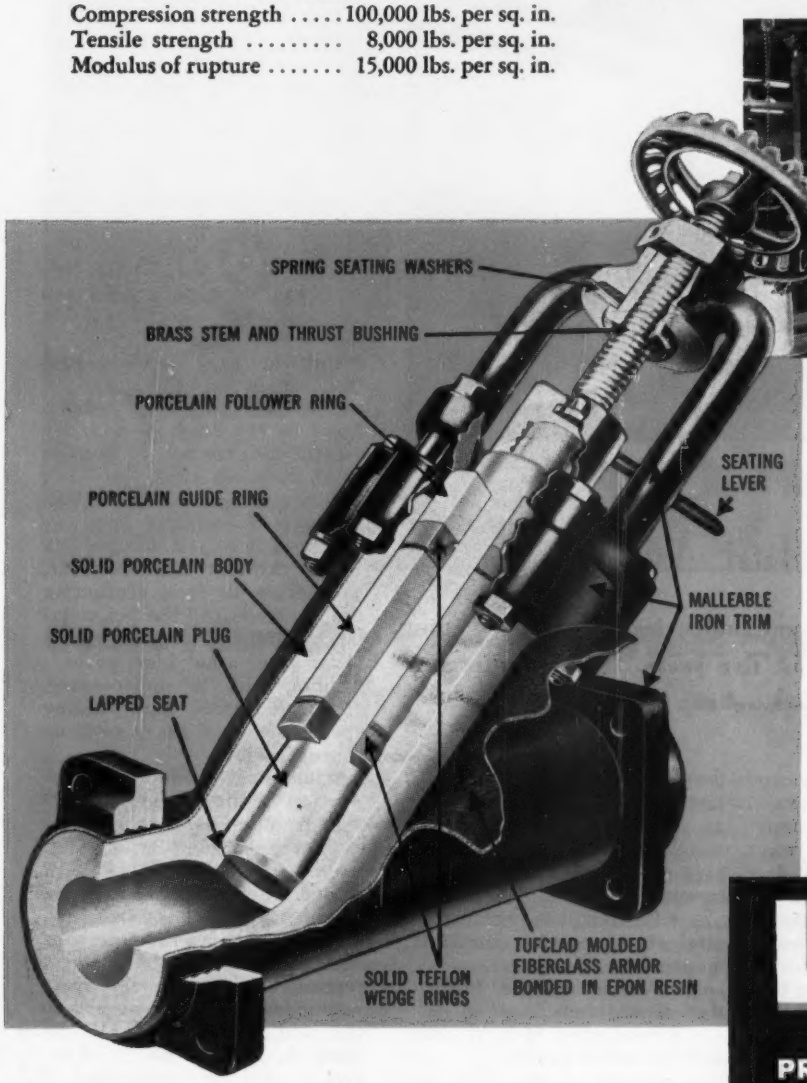
HIGH MECHANICAL STRENGTH

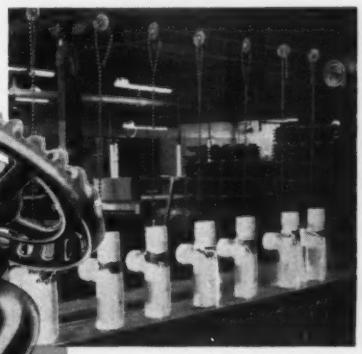
Compression strength ..... 100,000 lbs. per sq. in.
Tensile strength ..... 8,000 lbs. per sq. in.
Modulus of rupture ..... 15,000 lbs. per sq. in.

CHEMICAL RESISTANCE • Lapp Porcelain is unaffected by any acids except HF. It provides years of trouble-free service, handling hot acids in all concentrations, as well as mixed acids and other troublesome combinations.

UNIFORM QUALITY • Lapp Porcelain has been manufactured for 38 years for use in most severe chemical, electrical and mechanical services. Plant facilities include Lapp-patented vacuum processing, deaerating pug mills, two continuous tunnel kilns, and complete chemical, electrical and mechanical test equipment.

Write for bulletin with complete description, characteristics, and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 423 Wendell St., LeRoy, N. Y.





An electrical test is the most searching inspection for physical soundness! Porcelain bodies for Lapp valves above are being flashed over—at 70,000 volts for three minutes. Any physical defect is revealed as an electrical puncture.

Y-valves, angle valves, flush valves, safety valves, and plug cocks of Lapp Porcelain have standard bolt-circle flanges for easy connection to all piping and equipment.

Lapp

PROCESS EQUIPMENT

Chemical Porcelain Valves • Pipe • Raschig Rings
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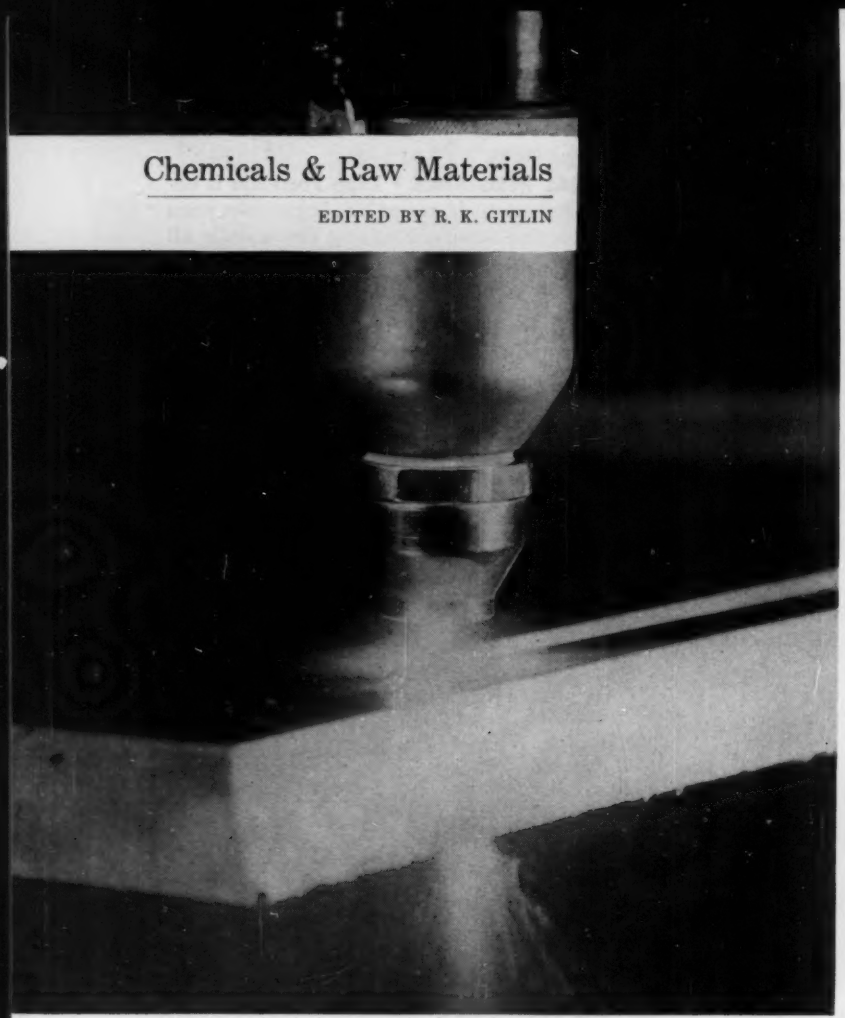

CUTTING non-ferrous metals looms as newest market for argon.

Argon: Inert but Active

Sparked by postwar industries, argon production has soared within the last five years. Now, non-ferrous metal fabrication promises to keep it rising.

A 300% production increase in five years is no mean achievement for any commercial commodity. But for argon, a so-called rare gas, the record is nothing short of phenomenal.

For although argon has been known for many years, it was little more than a laboratory curiosity until the beginning of World War II. Since 1950, argon production has jumped from 55 to 200 million cu. ft. per yr.

Paradoxically, argon's industrial importance hinges on its inertness. Prime markets—both current and anticipated—include:

- Cutting and shaping of non-ferrous metals—by using a high-speed, gas-shielded, constricted arc.
- Electric arc welding of steel, stainless steel, aluminum, magnesium.
- Production and fabrication of titanium.
- Production of light bulbs and electronic tubes.

In several of the above applications, argon vies strongly with helium, another of the rare gases. For many other purposes, it's become the preferred gas. One reason: unlike helium, whose only source of supply is the U. S. government, argon's purity and supply can be guaranteed.

▶**Shaping Non-Ferrous Metals**—Linde Air Product's recent announcement of its Heliarc cutting process (see p. 242)—using mixtures of argon and hydrogen—promises to be a big new outlet for argon production.

The new technique boosts cutting speed, slashes cutting and edge-preparation costs, simplifies non-ferrous metal fabrication, can be adapted to mechanized or manual operation. All this by using an extremely high-temperature, high-speed, gas-shielded constricted arc between a tungsten electrode and the piece to be cut.

Linde claims that Heliarc cutting will mean to non-ferrous cutting what oxygen cutting means to steel.

▶**Electric Arc Welding**—Biggest single outlet for purified argon (70% of total production) is the inert-gas-shielded electric arc method of welding steel, stainless steel, aluminum and magnesium. In this method, argon feeds through openings in the head of the welding rod holder around the electrode, preventing air from contacting the electrode and the hot metal being welded. Points in argon's favor (over other inert gases): welding flux is unnecessary, slag isn't formed, high welding speeds—even on heavy sections—are possible.

▶**Titanium Production**—Production of high-strength, rustless titanium is another vital market for argon. Because hot titanium readily reacts with oxygen or nitrogen, it must be shielded at all times from air.

Argon provides the necessary inert blanket to do the job, protecting titanium sponge from contamination during production and melting in the electric furnace. About 1 cu. ft. of argon is used for each pound of titanium sponge. Currently, about 5% of total argon pro-

Celite Filtration assures perfect clarity—

adds eye appeal and buy appeal to food products

TO GIVE foods and beverages that extra quality which results in more sales appeal, leading processors depend on Celite Filtration. The Celite method provides perfect clarity at high production rates.

Celite Filtration is *efficient.* It removes even the finest suspended solids. Moreover, Celite Filtration is *economical.* It may be used with any type of conventional filter, it is almost automatic, and only unskilled labor is required for routine operation.

And Celite Filtration is *flexible.* To meet your specific requirements, Celite comes in nine standard grades of microscopically controlled particle size. The right balance between degree of clarity and rate of flow may be easily controlled. You can obtain perfect clarity in food products—highest purity in antibiotics—complete removal of insoluble impurities from water, petroleum, chemicals, dry cleaning solvents and many other liquids.

A Johns-Manville Celite Filtration Engineer will gladly discuss the advantages and use of Celite in your product or production process. For his services, without obligation, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

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Johns-Manville CELITE INDUSTRY'S STANDARD FOR FINEST FILTRATION

Newsworthy chemicals this month

Argon production, consumption mounting . 144A
Organo-silicone oils 146A
Fire retardant paints 148A
Reinforced, irradiated polyethylene 148B
Synthetic natural rubber 148C
Substitutes for scarce red pigments 150A
Acrylic fiber cost cut 17-20% 150B
Polyester resin seals porous castings 150C
Poly battery parts lengthen battery life . . . 152A
New line of chlorofluorohydrocarbons 152B
Low-temperature plasticizer for rubber . . . 152C
Highly pure cellular metabolite 152D
Volume output of di-isodecyl phthalate . . . 152E
Concentrated H_2O_2 solutions 152F
Solvent for cured epoxies, plasticizers 152G
Difunctional ester disperses vinyls 152H

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duction goes to the titanium industry.

▶ **Bulbs and Electronics**—Although a number of gases have been used to fill lamps, argon with traces of nitrogen (to minimize argon's susceptibility to ionization, eliminate short-circuiting in the bulb) has cornered better than 90% of the market for incandescent, miniature incandescent, photoflash, fluorescent bulbs. Most recent figures show 7% argon production going into the electric and electronic fields.

The remaining 18% of annual production is distributed among the zirconium, tungsten and copper industries, metal-cutting tools, metal flushing (in refining), etc.

▶ **Production**—Although argon is sometimes a product of gas reaction such as ammonia synthesis, ammonia purge gas, it is primarily a product of air liquefaction.

Air is compressed and cooled —by heat exchange and expansion (Joule-Thompson effect)— until it liquefies. After impurities (CO_2, water, etc.) have been removed, liquefied air is fractionally distilled into various components — principally oxygen and nitrogen.

Argon, with a boiling point (–185.7 C.) between O_2 and N_2, is withdrawn from a selected zone in the column, recondensed, then purified by separate refining processes.

▶ **Distribution and Cost**—Argon is distributed in one of three ways, depending on customer consumption: (1) gas is delivered in compressed gas cylinders; (2) liquid is trucked to the plant where it's converted to a gas, then charged into installed receiver tubes; (3) liquefied argon is delivered and stored at the plant, then converted to a gas as the argon is required.

Price of purified argon (99.9%)—about 9 to 12¢ per cu. ft.—varies with quantities involved, place of production, fob. point, etc.

▶ **Who's Who**—Far and away the biggest producer of argon is Linde, accounting for about 80% of total U. S. production and an even greater percentage of sales.

Air Reduction, with an output of about 12-15% of the total, is second in line. Included among the most recent newcomers to the field are National Cylinder Gas (Ferndale, Mich.), Houston Oxygen (Texas). And among those rounding out the list of producers are Dow Chemical (Michigan) and Burdette Oxygen (Ohio).

For More Information . . .

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

According to Dept. of Commerce figures, the end of 1956 should see about 12 companies operating 21 plants with a combined producing capacity of about 550 million cubic feet. This figure, representing about twice current consumption, would seem to indicate that there's more than enough argon available for those interested in using it.

Going on the assumption that the market for argon is an ever-expanding one, gas producers are investing in development work aimed at better recovery, purification and new applications of this inert but active gas. 144A

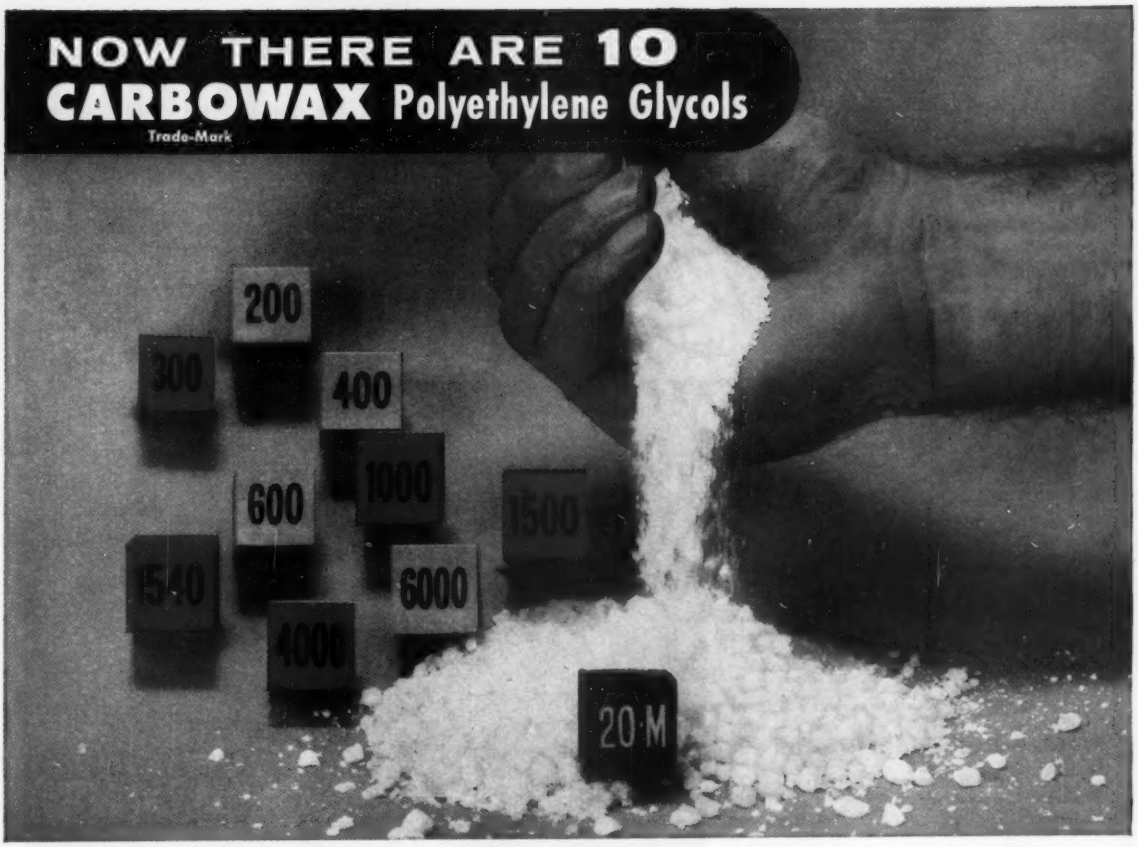
Organo-Silicone Oils

Possess unusual lubricating and solubility properties.

Six new so-called organo-silicone oils having lubrication and anti-wear properties rivaling those of petroleum oils can be used as emulsion breakers for oil products or as emulsifying agents.

Designated X-520, X-521, X-522, X-525, X-526 and X-527, these silicones also have excellent release properties, special thermal and viscosity stability and water repellency.

Because of their unique properties, the oils are expected to find wide use in rubber, plastics, lubricants, cosmetics, specialties.



The widest available range of these versatile compounds

CARBOWAX polyethylene glycol 20-M gives you new opportunities to use this versatile series. Because of its higher molecular weight, its melt and solution viscosities are higher, films formed from it are harder and stronger, and its lubricating action is greater.

Like all members of the series of CARBOWAX polyethylene glycols, 20-M is water-soluble, heat stable, and inert to many chemicals. And it has the binding and suspending properties characteristic of the series. Try 20-M in applications where mild thickening action and suspending power are desired, and as a rubber release agent where intricate molds require a more viscous lubricant.

CARBOWAX polyethylene glycols are widely used as solvents, humectants, lubricants, and intermediates. They have become increasingly important as vehicles for medicaments and cosmetics, as mold-release agents, textile lubricants, softeners, antistatic and conditioning agents, and as intermediates for surfactants and synthetic resins.

With the addition of CARBOWAX polyethylene glycol 20-M, the series has a molecular weight range of 200 to 20,000. The individual products vary in physical form from liquids through soft semi-solids to hard waxes.

The term "Carbowax" is a registered trade-mark of Union Carbide and Carbon Corporation.

For more information on these water-soluble polyols, just call or write the District Office nearest you.

In Canada:
Carbide Chemicals Company, Division of Union Carbide Canada Limited, Montreal and Toronto.

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AND CARBON
CHEMICALS

Carbide and Carbon Chemicals Company
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

• Rubber—Slip and release agents for molded products, tire bags.

• Plastics—Injection molding, release of laminates, cleaning and lubricating calendering rolls.

• Lubricants—Machine and metal lubricants, special high-temperature lubes with graphite, hot-forming or packaging machine lubricants, greases, processed film lubricants, glass bottle lubricant for anti-seize, etc.

• Cosmetics—Creams and lotions.

• Specialties — Defoaming, emulsification.

Of the six oils offered, four are water soluble, two are readily soluble in both high and low aromatic solvents.—**Linde Air Products Co., New York 17, N. Y.** 146A

Fire Retardant Paints

Slow down rate of burning; minimize damage, loss of life.

Containing certain pigments and oils which form a spongy insulating layer when subjected to heat, a new group of Army-developed, fire retardant paints slow down burning rate.

Already evaluated in the U. S. arctic, desert and tropics, the paints have been found to materially minimize loss of life and property. Added features: they possess all the esthetic and protective properties of good interior and exterior paints.—**U. S. Army Corps of Engineers, Fort Belvoir, Va.** 148A

High-Strength Poly

Retains its shape, is 5 to 8 times stronger at high temperatures.

Addition of reinforcing fillers to irradiated polyethylene boosts poly's tensile strength at high temperatures, cuts creep deformation by 90%. Compared with a high-grade, unfilled, unirradiated polyethylene which melts below 300 F., the new plastic can support more than 500 psi. at the same temperature.

Rounding out the new poly's list of virtues are excellent chemical and corrosion resistance, low-temperature flexibility, non-melting characteristics —features common to irradiated polyethylene.

Although work is being concentrated on carbon black as the reinforcing agent, studies of other plastic fillers are continuing. And proposed application surveys are under way to determine most important industrial outlets for the filled, irradiated plastic. — **General Electric Co., Schenectady 5, N. Y.** 148B

CORAL tread exhibits no cracks after tire travels 12,000 miles.

Another Synthetic Rubber

Chemically and structurally similar to natural Hevea, yet superior in thermal stability, cracking resistance.

One of the latest entries into the field of synthetic natural rubber is Firestone's Coral rubber—a cis-1,4-polyisoprene containing neither the trans-1,4 isomer nor distinguishable amounts of the 1,2 structure.

Made by polymerizing isoprene in the presence of a lithium catalyst, Coral is superior (in some respects) yet similar to Hevea natural rubber. (It's more like Hevea than older, emulsion-type polyisoprene preparations.)

Coral excels Hevea in thermal stability, oxygen absorption and resistance to cracking in tire treads. Hevea-like properties are indicated by infrared structure, X-ray crystalline pattern, perbenzoic acid determination of 1,4 addition, ozonolysis, unsaturation, carbon-hydrogen ratio, molecular weight distribution, inherent viscosity and specific gravity.

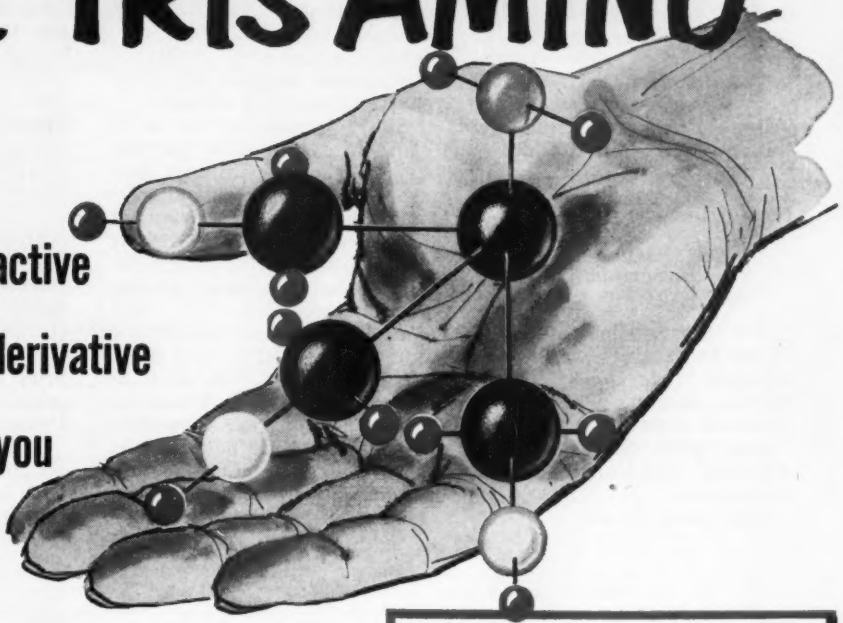
These characteristics account for its low hysteresis, high gum tensile, good retention of physical properties at temperatures from 212-275 F.

Prime market for Coral will be heavy-duty tires—in plies, tread plies, inserts and treads—where wear and cracking resistance, heat dispersion are important. In service tests of over 500,000 tire miles, tread wear with Coral has averaged about 95% that of natural rubber.

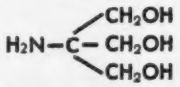
Although cured Coral stock boasts of better building tack

meet "TRIS AMINO"

See what this highly reactive nitroparaffin derivative might do for you



"Tris Amino" is short for Tris(hydroxymethyl)aminomethane. This chemical is unique. It is the only tri-hydroxy molecule commercially available having a primary amine group.



Tris Amino is a raw material undergoing a very wide variety of chemical reactions. The reactivity of Tris Amino makes it of unusual interest in chemical synthesis, since it contains a primary amine group *and* three primary reactive hydroxyl groups. Manufacturers of resins, synthetic drying oils, and surface active agents cannot afford to overlook the potential usefulness of Tris Amino as a raw material.

Tris Amino reacts with higher fatty acids to form soaps with unusually strong emulsifying power. Relative high boiling point and low combining weight recommend the use of Tris Amino in preparation of cosmetic creams, textile specialties, cleaning compounds and many other emulsions.

CSC's great new Nitroparaffins plant at Sterlington, La., is now in full production assuring certain, constant supplies of Tris Amino.

PROPERTIES

Molecular Weight	121.14
Boiling Point, °C	219 to 220 10mm
Melting Point, °C	171-172
pH of 0.1M Aqueous Solution at 20°C	10.4
Solubility in Water at 20°C, g/100 ml	80

Other Aminohydroxy Compounds

AB (2-Amino-1-butanol)
AMP (2-Amino-2-methyl-1-propanol)
AMPD (2-Amino-2-methyl-1, 3-propanediol)
AEPD (2-Amino-2-ethyl-1, 3-propanediol)

Now available in semi-commercial quantities.

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Title_____
Company_____
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City_____ Zone_____ State_____

and lower hysteresis than GR-S, it will be somewhat higher priced than GR-S. However, the new synthetic rubber is expected to compete favorably with natural rubber at current prices.—**Firestone Tire and Rubber Co., Akron 7, Ohio.** 148C

New Red Pigments

Cheap replacement for scarce cadmium sulfo-selenide reds.

For those who have been plagued by scarcity of cadmium selenide reds, one of the world's largest producers of chemical pigment colors is offering economical and more effective substitutes, Mercadium reds.

The new pigments—combination of cadmium and mercury sulfides—are somewhat cheaper, yet offer equal performance, greater brilliancy and cleaner hue than the sulfoselenides they will replace.

Since production of Mercadium reds involves calcination at high temperatures, they are insoluble in industrial processing media, heat resistant at high temperatures, extremely fast to alkali and to deteriorating effects of exposure to sunlight and weather.

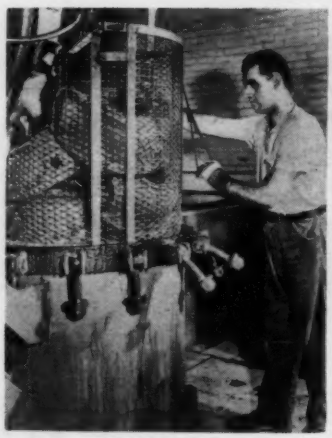
Light and dark shades are currently available; four intermediate shades will soon be added to the line. Industries most likely to reap immediate benefits from the new reds include latex and emulsion paints, lacquers, automotive finishes, textiles, printing inks, rubber, paper products, ceramics.—**Pigment Color Div., Imperial Paper and Color Corp., Glens Falls, N. Y.** 150A

Cheaper Acrylic Fibers

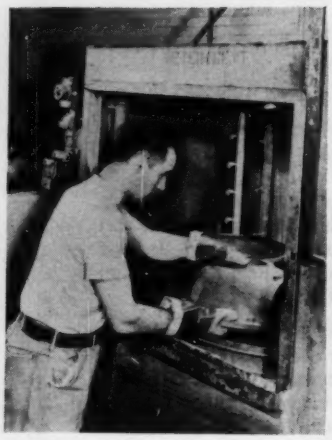
Cost of Acrilan, Dynel, Orlon staple and tow fibers cut by 17-20%.

Maneuvering for a larger slice of the expanding clothing market, the three big acrylic fiber manufacturers (Chemstrand, Union Carbide and Carbon, DuPont) have announced price cuts for their respective products—Acrilan, Dynel and Orlon.

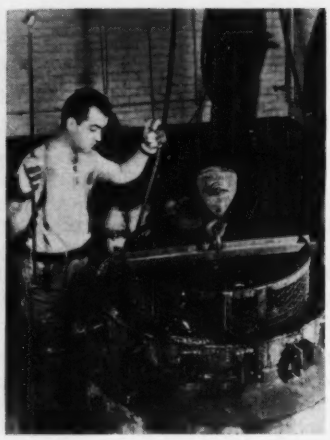
Acrilan's price has been cut by 20%, Dynel's by 18%, Orlon's by 17%. For comparison: two and three denier Acrilan



Impregnation . . .



Rinsing . . .



Curing . . .

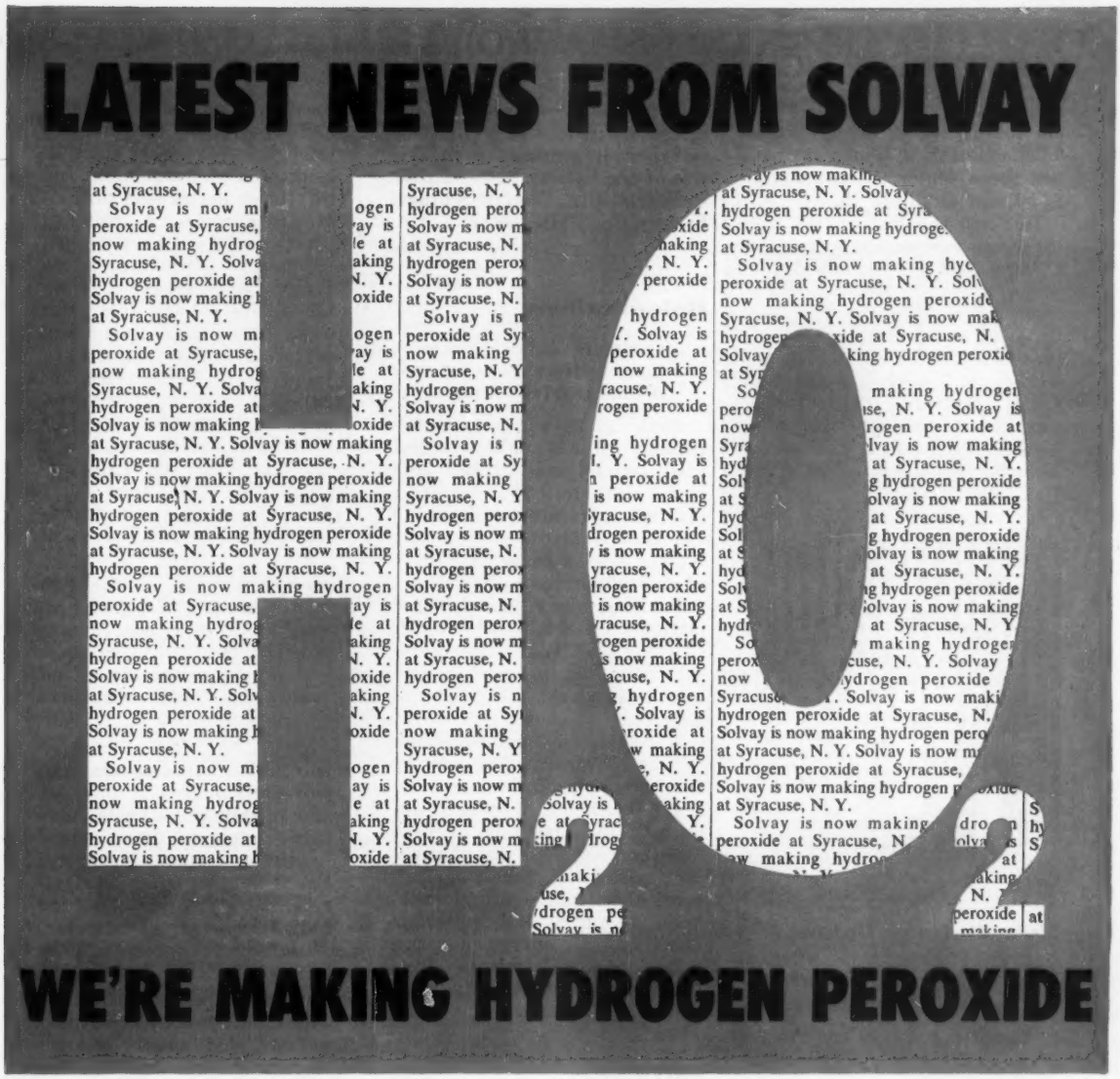
Castings Sealed in Less Time With New Resin

Savings in both production (20%) and cycle time (40%) to seal porous metal castings are possible with a new polyester sealant, Impco RC-2.

Compared with conventional sealants which require 8-hr. production cycles and several recyclings for a complete seal, RC-2 does the job in five hours with one cycle. Also in its favor is the minimizing of sealant bleeding from casting pores—not only a potential fire hazard, but also a time- and labor-consuming procedure.

In a typical sealing operation, porous castings of a crankcase front section are placed in a pressure vessel and impregnated with RC-2. Castings are then rinsed with warm water and a mild detergent to remove excess self-emulsifying resin. (Other sealants require flammable solvents to remove excess film from castings.) Cleaned castings are immersed in a tank of hot oil (270 F.) to cure the resin.

Impco RC-2 gels quickly, forming a hard solid in 1-1½ hr. Each casting is tested for leaks in water at 180-200 F. and pressures up to 70 psi.—Bakelite Co., New York, N. Y. 150C



The news that SOLVAY is producing hydrogen peroxide in a new plant at Syracuse, N. Y. is of threefold importance to users of this product.

1. It provides a new dependable source of supply for material of top quality—SOLVAY quality.

2. It means that hydrogen peroxide can be purchased in mixed carload or mixed truckload lots with other SOLVAY products.

3. It makes available, without obligation, SOLVAY's specialized, industry-wise Technical Service.

Hydrogen peroxide, in addition to its many, well-known bleaching applications in industry, is important in such newer uses as in the manufacture of organic chemicals through epoxidation and hydroxylation reactions.

Put SOLVAY Hydrogen Peroxide to work in your products or processes. Now available in both 35% and 50% grades, you can get it in both drums and tank cars—shipped in carloads or truckloads, straight or mixed, as well as l.c.l. Write for further details on prices, general information and technical data.

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Potassium Carbonate • Calcium Chloride
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Ammonium Bicarbonate • Caustic Potash • Chloroform
Sodium Nitrite • Caustic Soda • Methyl Chloride
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Para-dichlorobenzene • Ortho-dichlorobenzene • Hydrogen Peroxide

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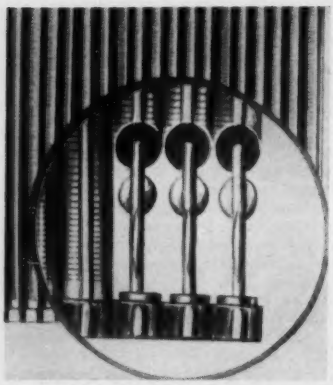
staple sell for $1.18 and $1.12 per lb.; Dynel, in deniers from 3-24, sells for $1.15 per lb.; two and three denier Orlon sell for $1.30 and $1.25 per lb.

DuPont, the last of the big three to announce a price change, has also dropped the cost of nylon (16-20%) and Dacron (13-20%) and has introduced a new Orlon staple, type 39, aimed at markets now held by wool—**Chemstrand Corp., Decatur, Ala.; Union Carbide and Carbon Corp., New York 17, N. Y.; E. I. du Pont de Nemours & Co., Wilmington 98, Del.** 150B



Poly Battery Parts

Lengthen battery life, increase initial capacity.

Versatile polyethylene has become a vital part of industrial storage batteries.

It is now being used exclusively in tubing and tube sealers which encase the active material and grid spines of positive plates in all Exide-Ironclad industrial batteries.

Exide's complete switch to plastic construction (already in use in electric industrial truck batteries, railway car lighting and air conditioning batteries) is based on polyethylene's advantages:

- Lengthens battery life—by 20% or more.
- Makes possible higher initial capacity.
- Withstands wide range of battery working conditions.
- Tubing can be slotted to a greater percent porosity than rubber.

Effectiveness of polyethylene battery parts allows for increase in plate size without a corresponding increase in the size of the battery case.—**Exide Industrial Div., Electric Storage Battery Co., Philadelphia 1, Pa.** 152A

Haloparaffins

Complete line of chlorofluorohydrocarbons for propellants, refrigerants.

Banking on accelerated expansion of two markets—aerosols (paints, insecticides, specialty cleaners, cosmetics, etc.) and refrigeration equipment—Pennsalt is introducing a new Isotron line, a complete family of chlorofluorohydrocarbons.

Initial products include three methane derivatives: CCl_3F, CCl_2F_2 and $CHClF_2$. Early additions to the line will be ethane derivatives: $C_2H_2Cl_3F$ and $C_2Cl_2F_4$.

Although Isotron production will be concentrated on serving the aerosol propellant and refrigerant fields, Pennsalt anticipates increasing use of these fluorine chemicals in pharmaceuticals, metal fluxes, agricultural chemicals, synthetic rubbers, ceramics and materials for the atomic energy industry. —**Industrial Chemicals Div., Pennsylvania Salt Mfg. Co., Philadelphia 2, Pa.** 152B

BRIEFS

A low-temperature plasticizer for both synthetic and natural rubber, triethyl glycol dipelargonate, has been introduced commercially under the name Plastolein 9404 TGP. Compared with other triglycol esters and the adipates, 9404 (derived from ozonolysis of oleic acid) gives lower heat loss, less water sensitivity, lower compression set, equivalent low-temperature flexibility. — **Emery Industries, Cincinnati 2, Ohio.** 152C

Inosine, a cellular metabolite important in growth studies, is now available in chromatographic purity. Cost: $6 per 5-gm. bottle.—**Schwarz Laboratories, Inc., Mt. Vernon, N. Y.** 152D

Di-isodecyl phthalate's price and superior performance are the prime reasons for starting commercial production of this most permanent phthalate plasticizer. A primary plasticizer for most resins, di-isodecyl phthalate offers these advantages: shows much less volatile loss than other widely used plasticizers, retention of low-temperature properties in aging tests, imparts permanent flexibility, good low-temperature flexibility, heat and light stability, low migration, low water extraction. — **Ohio-Apex Div., Food Machinery and Chemical Corp., Nitro, W. Va.** 152E

Hydrogen peroxide solutions in concentrations of 90% to almost 100% H_2O_2 content are now commercially available. —**Becco Chemical Div., Food Machinery and Chemical Corp., Buffalo, N. Y.** 152F

A solvent for cured epoxies and polyesters makes it possible now to salvage valuable parts from defective units potted in those resins. Monastrip EP is noncorrosive, nonflammable and reusable.—**Mona Industries, Inc., Paterson, N. J.** 152G

Difunctional ester, Monomer MG-1, acts as an efficient dispersant for vinyl chloride dispersion-type resins, but polymerizes during resin fusion to a hard material which retains no plasticizing action. It can be copolymerized with styrene, vinyl chloride, vinyl acetate, acrylates and other monomers. Possible applications: paper and leather impregnation, calendering, extrusion and other hot-processing techniques. — **Carbide and Carbon Chemicals Co., New York 17, N. Y.** 152H

For More Information . . .

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

Information! How to Purchase and use RADIOCHEMICALS

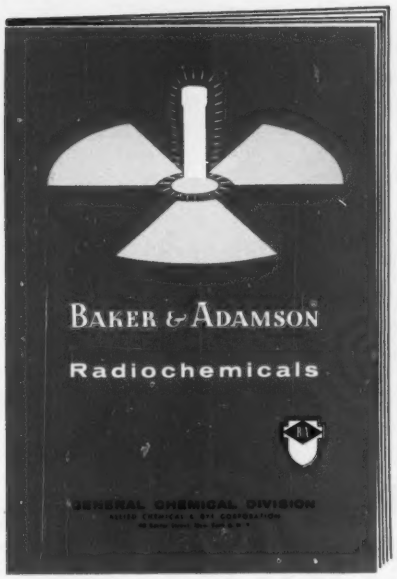
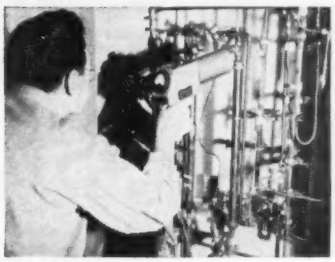
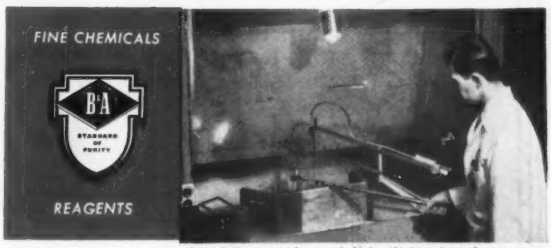


Illustration from catalog showing use of radioactive piston ring to study engine wear (Standard Oil (N.J.) Photo)



The ready detectability of radiochemicals makes them extremely valuable for analytical purposes.



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The booklet is simple, clear, instructive; written for the non-technical management man as well as the laboratory scientist. Besides telling what radiochemicals are, it includes:

- Information on the most important fields of use.
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- Formulae, specific activities, energy in MEV of principal radiations.
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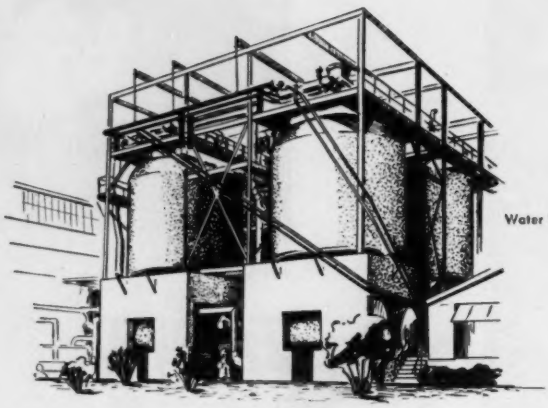

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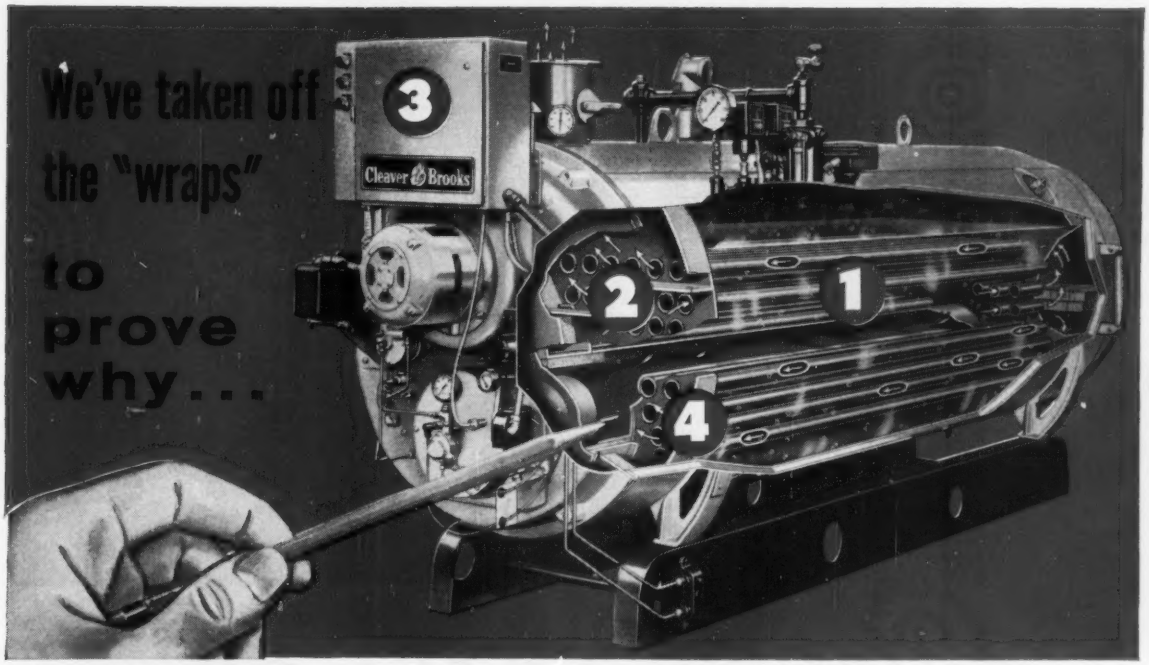
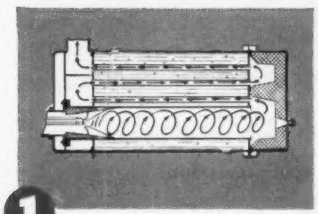
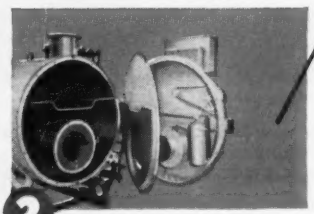


CB is America's most modern boiler

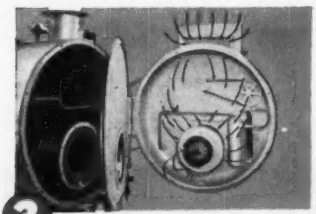
unmatched in performance quiet operation low-maintenance



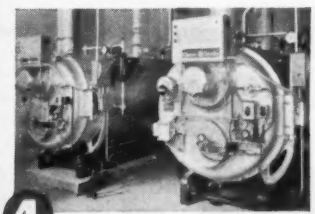
1 **Four-pass design with forced draft** — Proved the most efficient combination to transmit greatest percentage of heat to boiler water. Blower provides cool, clean air in required density and volume for efficient fuel combustion — lowers fuel costs.



2 **Hinged doors front and rear** — Expose tubes for quick inspection or cleaning. Operating equipment and refractory stays intact. Cuts routine maintenance from hours to minutes. Doors are gasketed with preformed asbestos to be seal-tight.



3 **Caseless fan keeps operation "hospital quiet"** — Air is drawn into a large plenum chamber which confines and deadens air noises. Even at peak loads, CB is well within requirements for low sound levels where this is a factor.



4 **Automatic controls are centralized for convenience, efficiency and safety** — Air is metered with oil (or gas) in proper ratios to economize on fuel. Electronic flame failure control is standard equipment.

CB boiler's remarkable performance in hundreds of applications has proved an "eye-opener" wherever installed. Take a minute's time and see why.

Combined into one boiler package are all the features *proved necessary* to: (1) save fuel dollars, (2) simplify maintenance, (3) assure silent performance, (4) maintain safe, automatic operation.

Talk to your nearby Cleaver-Brooks boiler representative — he can assist you in selecting the proper unit from a complete line of sizes, steam or hot water, 15 to 250 psi. Or, write direct for literature. Cleaver-Brooks Company, Dept. B, 344 E. Keefe Ave., Milwaukee 12, Wis., U.S.A. Cable Address: CEEBEEWEST — all codes.

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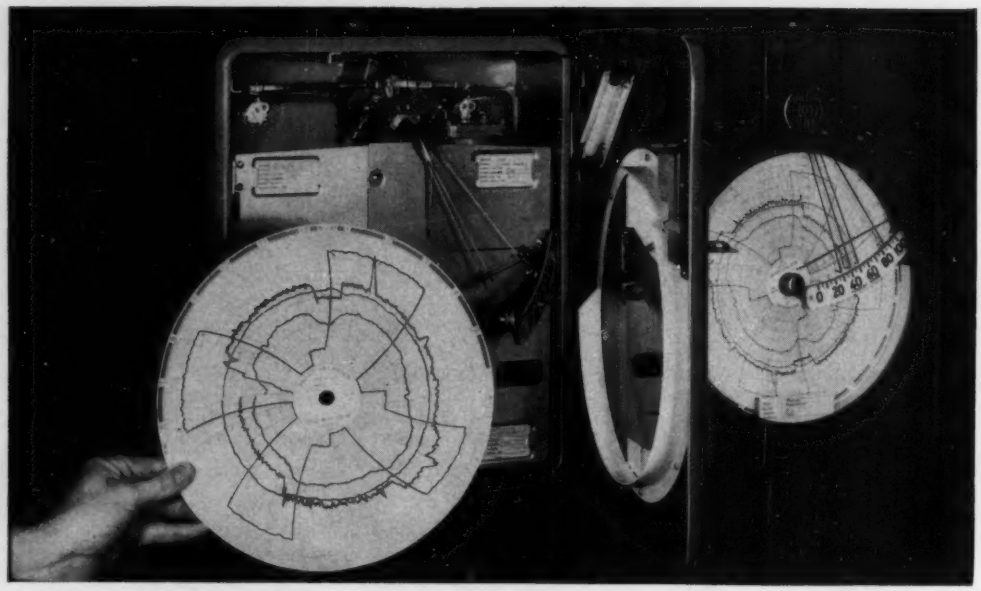

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Clear, Continuous Records without Poisoning . . . on the New Bailey Recorder

★ Faithful chart records of measured variables are the key to a meaningful, dependable analysis of operating trends and conditions. Money spent for more accurate metering, for faster response, is money down the drain—*unless* it's matched with chart records that are equally accurate.

That's why these features of the new Bailey Recorder are important to you:

1. Bailey's exclusive sealed capillary-action inking system maintains continuous flow to the pen tip, and traces sharp, opaque, quick-drying records. "Poisoning" of intersecting records is practically eliminated; no blots or smears during operation or chart changing.

2. Pens are mounted on concentric centers, trace on parallel time arcs only 42/1000″ apart. This simplifies analysis of two or more records.

3. Interchangeable plug-in receiver units permit practically limitless record-grouping combinations.

Write for Product Specification E12-5 and actual chart sample.

ONLY BAILEY OFFERS ALL THESE ADVANTAGES IN A SINGLE RECORDER

- Pre-calibrated plug-in receiver units
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EXON: each resin engineered for a specific problem

EXON solution resins

varying in properties to suit specific needs

Your needs are the blueprints of Firestone engineers. There are several distinctly different Exon solution resins to solve industry's varied problems regarding application, purpose, performance conditions and surfaces. The significance is this: if you require a solution resin specifically engineered to fit your particular set of problems, you're likely to find it in the growing line of Firestone Exon resins. For example:

Firestone

EXON 450 Good solubility, film tensile strength and durability allow formulations to be based on this one resin alone. Coatings can be spray-applied, and strip off cleanly and easily.

EXON 461 Fluorinated, non-flammable, thermoplastic. Soluble in aromatic, ketone and ester type solvents. Films adhere to porous substrates, show excellent heat and light stability, exceptionally low vapor transmission, good resistance to inorganic chemicals including concentrated acids and alkalies.

EXON 470 Excellent adhesion to metals, alkyd and vinyl surfaces. Compatible with various drying oils, alkyds, phenolics and melamines. Highly soluble in ketone solvents. Good aromatic tolerance.

EXON 471 has excellent solubility. Unmatched as a protective coating. Corrosion resistant, adheres to vinyl, paper and cloth. Will adhere to wash primer. Common lacquer techniques can be used in application of coatings. Numerous solvent systems are possible, permitting use in a wide variety of applications.

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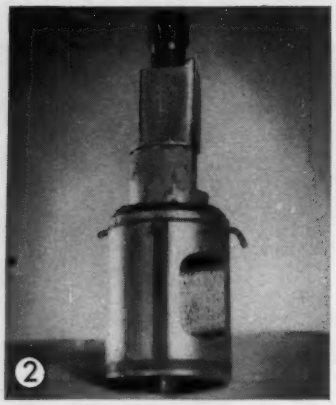
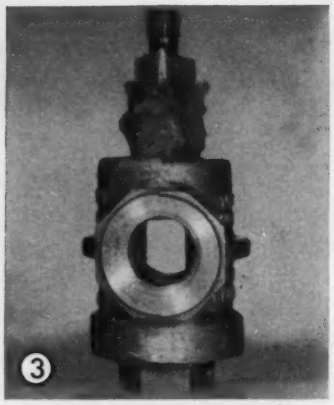
*SEE HOW *Controlled*
PRESSURIZED LUBRICATION
GUARANTEES LOWEST COST SERVICE FROM
HOMESTEAD *lubricated* PLUG VALVES

This plug was removed from a Homestead Valve just after starting lubrication, and before all sealing areas were filled with lubricant. Note that pressurized lubricant continues to extrude through feeder holes. Momentary downward movement of plug at start of each lubrication, gives assurance that plug is always free to turn.

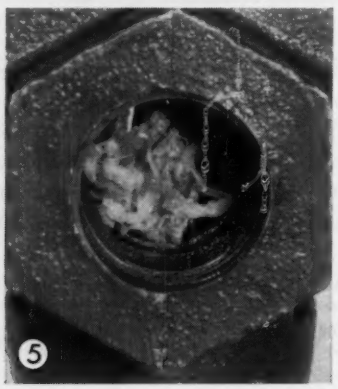


The plug was again withdrawn from the valve body just after a ring of lubricant around the stem indicated that the lubricant system was full. Note that all lubricant grooves are filled. The entire plug surface is coated with lubricant. Lubricant is well packed in the stem sealing area above the plug.



Now valve has been purposely over-lubricated as indicated by excess lubricant around stem. Note that with *controlled* pressurized lubrication there is no extrusion or seepage of lubricant into valve port opening. This means no waste, no contamination of line fluids, no clogging of low pressure lines with lubricant, or fouling of meters, orifices, etc.

Also, in the Homestead Valve with *controlled* lubrication, you will note that even though the valve has been over-lubricated, lubricant comes only to the bottom edge of the plug, and is not wasted by discharging in quantity into the bottom chamber.



Now, see for yourself the risk involved when a valve which does *not* have Homestead's *controlled* Pressurized Lubrication, is over-lubricated. Note lubricant has been forced into the port opening. It can contaminate line fluids, foul meters or orifices, or even block low pressure lines!

* Unretouched photos.

These are but a few of the many advantages of Homestead's controlled pressurized lubrication that guarantee lowest cost valve service.

Reference Book 39-5 has the full story—twenty-eight pages of engineering facts, sizes, types, dimensions, etc. Ask for your copy today. There is no obligation.

HOMESTEAD LUBRICATED PLUG VALVE (Pat. Pend.)

HOMESTEAD VALVE MANUFACTURING COMPANY

P. O. Box 13 *"Serving Since 1892"* Coraopolis, Pa.

Report.....on CHEMICO

Sludge Acid Regeneration Plants

CONSOLIDATED CHEMICAL INDUSTRIES

Division of Stauffer Chemical Company
640 NELLIE ESPERSON BUILDING
HOUSTON 2, TEXAS

December 7, 1955

AIR MAIL

Mr. J. H. Ruskin
Executive Vice President
Chemical Construction Corporation
525 West 43rd Street
New York 36, New York

Dear Mr. Ruskin:

I want to tell you that we are very much pleased with the manner in which our Baytown and Houston, Texas, Sulfuric Acid Regeneration Plants are performing.

We think that your organization applied itself most diligently and efficiently to the design and construction of these two plants.

We mean sincerely the things we are stating in this letter and we trust that you and your organization will continue to prosper and we look forward to having you do engineering and construction work for us in the future.

Very truly yours,

E. S. Rothrock

Vice President

performance

design and construction

future work by Chemico

CHEMICO has designed and constructed 4 plants, with a total rated capacity of over 500,000 tons of Sulfuric Acid a year, for Consolidated Chemical Industries, Inc. These plants recover sulfuric acid of commercial purity from refinery acid sludges.

A unique design feature of CHEMICO's Sludge Acid Regeneration Plants is the utilization of the fuel value of the sludge, thereby greatly reducing the supplementary fuel required.

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A Unit of American Cyanamid Company

525 WEST 43RD STREET, NEW YORK 36, N. Y.

CC 304

NEW DESIGN FEATURES OF LEAKPROOF "CANNED" PUMP

extend applications . . .

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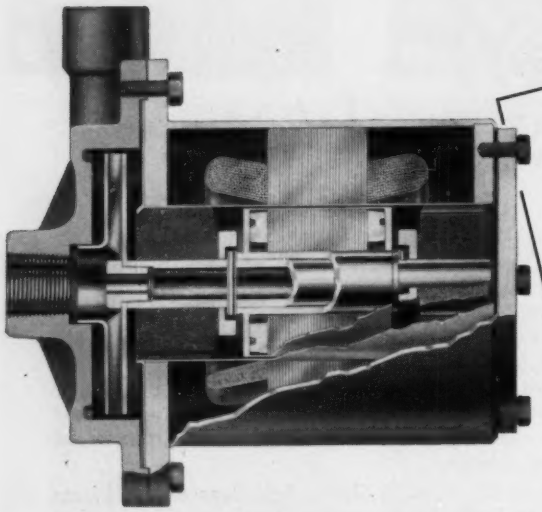

- **New fabricated construction** is simpler . . . permits mass production techniques. You benefit through lower cost.
- **Construction materials** include titanium, Monel, Carpenter 20, Hastelloy B, Teflon and stainless steels.
- **400% greater bearing area** provides greatly extended service life. Bearings are semi-floating . . . easy to inspect or replace.
- **Series S Chempumps** give leak-proof service at heads to 94 feet, capacities to 50 gpm.

Fifteen years of design and operating experience are built into this new *low-cost* sealless Chempump.

You will benefit directly. You get the cost-saving advantages of mass production techniques. You get a choice of materials of construction that can handle practically any known corrosive. You get a "canned" pump that can't possibly leak, that requires no lubrication, that virtually eliminates maintenance. Oversized, semi-floating bearings give thousands of hours of service under difficult conditions . . . cut-outs provide foolproof motor winding protection for both overcurrent and excessive heat.

The new Series S Chempumps will be available shortly in ⅓ and ¾ horsepower sizes, with larger units coming. The price is competitive with a quality centrifugal equipped with a mechanical seal. Talk with the Chempump engineering representative in your area about saving through quantity purchases.

- *For complete details, write for Bulletin 1030*

CHEMPUMP CORPORATION
1300 E. Mermaid Lane, Philadelphia 18, Pa.

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BRIDGEPORT BRASS COMPANY

CONDENSER AND HEAT EXCHANGER TUBE EDITION

COPPER ALLOY BULLETIN

Bridgeport Brass Co. MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

New Electronic Spectrograph Maintains High Tube Quality

One of the important aspects of the manufacture of heat exchanger tubes is the maintenance of uniformly high metallurgical standards.

Metallurgical quality control has been of prime importance to Bridgeport Brass for many years, since it is essential to top product performance as well as customer satisfaction.

Whenever possible, Bridgeport has utilized the latest advances in product quality control, developed new techniques for analysis, and adopted new instruments to aid metallurgists in maintaining uniform quality. A typical example of this is the use of a newly developed electronic spectrograph to analyze the composition of alloys from which Bridgeport makes heat exchanger and condenser tubes.

In operating this spectrograph, a small cast sample of the alloys is positioned in the instrument. By means of an electric arc the sample is instantaneously heated to a vapor state. This vaporized portion emits a brilliant light which, by means of a grating, is broken up into the component wave lengths of the various elements present in the specimen in much the same way daylight is divided into a multihued spectrum by a prism. These wave lengths are directed on a battery of sensitive photoelectric cells, and the voltage developed by the cells as a result of the light striking them is measured and used as the controlling medium. A ratio of the intensities of the wave lengths is automatically recorded on a chart and calibrated to permit a direct reading of the percentage of each element in the sample.

With Bridgeport's Spectrometer it is possible to make a complete analysis of a sample containing as many as 14 elements in less than five minutes. Formerly, an analysis could take as long as 16 hours to complete.

Bridgeport was one of the first companies to use this instrument for copper-base alloy analysis. Both company metallurgists and production experts derive important benefits from electronic analysis as compared with the standard spectrographic and chemical methods.

At Bridgeport's plants, billet samples taken from casting furnaces are sent via pneumatic tubes to the electronic spectrograph. Because an analysis is completed in a matter of minutes, changes in the mixture in many instances can be made before the next sample is taken.

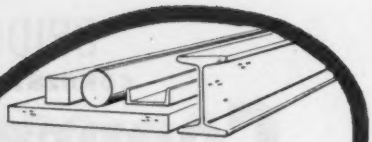
Bridgeport's condenser tube customers are benefiting directly by this improved spectrograph service. The electronic spectrograph has helped to combat corrosion by accurately determining the exact alloy composition for any given tube service in addition to lowering production costs, reducing waste, and stepping up movement of metal from furnaces to rolling mills. By reducing the load on photographic-type spectrographs for analysis, production of top-quality metal is accelerated, permitting improvement of Bridgeport's policy of giving immediate consideration to customer's specifications and analysis requests.

Drum comparator (above, left) quickly indicates compositions determined by spectrograph.

In addition to achieving more control by use of the spectrograph, the mechanics of alloy analysis have been greatly speeded. As a result, Bridgeport metallurgists are able to devote more time to research and experiments with new alloys for heat exchanger and condenser tubes.

Use of the electronic spectrometer marks a tremendous advance in product testing and control. Addition of this instrument to its facilities is just one of the many forward-looking steps constantly being made by Bridgeport Brass to bring better condenser and heat exchanger tubes and service to its customers. (4389)

call Ryerson for steel



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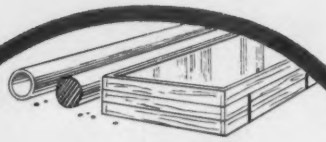

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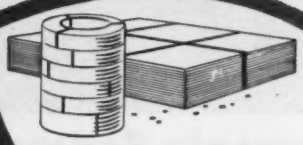

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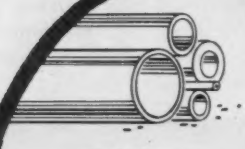

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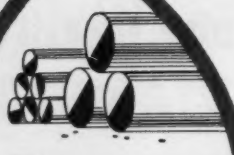

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Tested alloys of known hardenability, standard and aircraft quality, as rolled, annealed, heat treated.

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Need steel in a hurry? Ryerson stocks are the nation's largest, so one call to your nearby Ryerson plant brings quick delivery of almost any kind of steel in almost any quantity—all of it certified for high uniform quality.

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Of course, current heavy demand makes it difficult to keep all sizes always on hand but our stocks are being replenished continuously. Steel that's out of stock today may be in stock tomorrow. And experienced Ryerson steel men will help you make the most of steel on hand. So for everything in steel and steel service . . . call Ryerson.

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Chemical Engineering
February 1956

For Heat, Evaporation and Concentration, Gas Generation

Submerged Combustion Flares Anew

Because of

- Low First Cost
- Minimum Scaling
- Minimum Corrosion
- High Heat Utilization

CALVIN S. CRONAN, Associate Editor

LIKE a typed movie star, submerged combustion has built a reputation for a number of years in a single role—heating steel pickling baths. Steel producers know it can be installed economically, withstands the hot corrosive acids for long periods of time. And operation is low cost with maximum heat utilization and no dilution of acid.

Talent successful on one stage doesn't necessarily bring all the other producers running with contracts, however. But the backers of submerged combustion attest to mounting evidence that the operation is carving a place for itself in other fields, notably chemical and chemical process.

Even the typed movie star can't build a new reputation, either good or bad, unless the boys will talk about her. Those who have adopted submerged combustion apparently feel they've gained a competitive edge and have kept quiet. So there's been little public acclaim for submerged combustion and limited reputation.

Maybe you've been missing a good thing. With that in mind we'll show you what submerged combustion can do today that may improve your process tomorrow.

It's That Simple

If you were to light off a giant blowtorch under water you'd have the rough equivalent of a submerged combustion burner. And like a blowtorch it applies the heat directly where it will do the most good. There's no need for rigid heat transfer surfaces or for a source of steam.

That's the outstanding feature of submerged combustion. Hot gaseous combustion products transfer heat directly through the bubble boundaries into the body of liquid. There are no heat transfer surfaces to scale or foul, no gradual loss of efficiency.

Concentrated Energy

If you are familiar with the outlandish energy releases of the atomic age you will consider the comparison between submerged and conventional combustion a puny one indeed. In terms of space saving alone it's significant, however.

Submerged combustion can liberate between 4 and 5 million Btu. per cu. ft. per atmosphere per hr.; conventional fireboxes operate in the 20,000 to 40,000 range. Heat loss by radiation to the atmosphere is held to a negligible amount by the liquid blanket surrounding the burner.

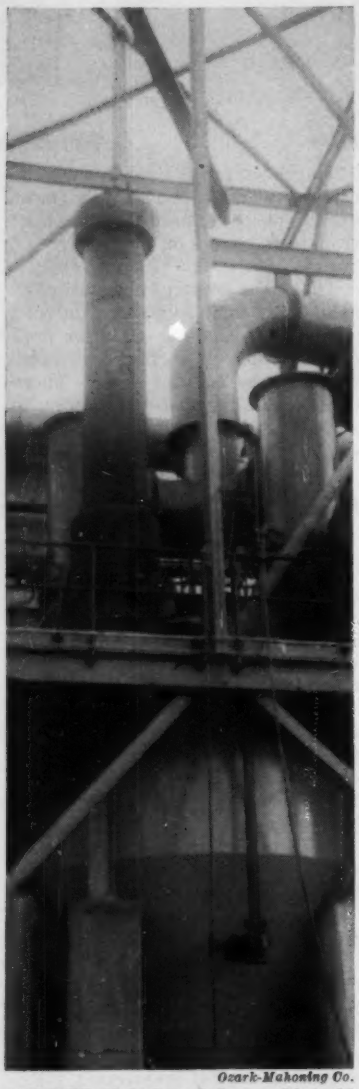
It's been estimated that one cubic foot of gas, exhausting into liquid at 3-ft. depth, will develop 1.6 acres of bubble surface for transferring heat under normal conditions. All in all, it adds up to high transfer rates, more compact installations, decreased capital investment, lower operating and maintenance costs.

And units can operate economically under highly corrosive conditions.

Aside from being a source of heat, submerged combustion can operate to carbonate, oxidize, reduce or generate inert atmosphere. So as a mixer, heater, evaporator and gas generator it is a four-pronged process tool.

Look Before You Jump

Even so, it is a tool that you must select with care. Otherwise, certain of its traits could cause you operating grief.



Ozark-Mahoning Co.

BURNER 18 ft. long is lowered into 20 million Btu. per hr. acid concentrator.

For instance, submerged combustion exhausts large volumes of gas through the body of liquid being concentrated. In some cases, this flow of gas entrains sufficient liquid to become a problem. Various types of scrubbers are believed the best way to remove entrainment.

One manufacturer now awaits results from a new installation that incorporates an entrainment separator. If successful, this approach should decrease future trouble from this source.

Still other problems arise from passage of the gas through liquid. In some cases, high liquid surface tension may prevent some of the gas bubbles from rupturing when they reach the surface. Then foam forms to choke the vapor space, making the operation impractical.

Or again, the combustion gases may be incompatible with or contaminate the liquid. This is a major factor to consider in chemical applications.

To date, manufacturers of submerged burners have not come up with a generally acceptable oil-burning unit. Attempts so far have centered around pre-vaporization of the oil, which in itself presents some real problems. And even assuming good operation there still exists the possibility of the burner exhaust contaminating the liquid.

One point to remember is that the tremendous amount of energy released within the small combustion chamber may cause vibration. In particular, cone-bottomed tanks used with some open-end burners for severe scaling conditions may require that design allow for vibration.

Other types of burners, discussed below, minimize vibration and surging as well.

Basic Design Often Modified

Burner designs vary between different manufacturers but basically most units on the market are vertical, cylindrical combustion chambers operated in a liquid environment. An exception is one that has the combustion chamber above the liquid level yet still exhausts below the surface.

How the exhaust gases must enter the liquid has much to do with how the burner looks. The simplest design discharges gas directly from the end of the cylindrical chamber or through a restricting orifice plate. Or the end of the chamber may be blocked off, with a series of holes around the periphery serving as exhaust ports. Again these ports may be fitted with elbows discharg-

Where You'll Find Submerged Combustion

Heating
- Soda ash metal cleaners
- Acid liquor for pickling steel
- Electroplating baths
- Dye baths
- Water at high temperature and pressure for Frasch mining of sulfur, and water at regular temperatures

Evaporation and Concentration
- Caustic liquor from 50 to 73% solids
- Calcium chloride containing HCl
- Sodium sulfate
- Whey
- Table salt
- Rayon spin-bath liquor
- Recovery of maleic acid from phthalic anhydride waste stream
- Potash
- Waste citrus peel liquor
- Fluoborate

Reacting
- Oxidation of asphalt
- Carbonation of alkalis
- Neutralization of waste liquors
- Recarbonation of water in softening process
- Production of oxidizing or reducing gas

Inert Gas Generation
- Purging of H_2S from oil field flood waters
- Delivery of gas containing less than 1% combined O_2 and CO for blanketing

ing downward in a larger circular pattern.

The combustion chamber may have two different cross sections with the exhaust ports located around the periphery of the larger. Or it may be tee or ell shaped, exhausting along or from the outer end of the arm(s).

Vessels holding the liquid undergoing heating or treating have many shapes and sizes, again dictated by the job. Simple round tanks with cone or flat bottoms are commonest for process use although a rectangular tank is used for steel pickling.

One variation, more a heat exchanger than a vessel, eliminates large tankage, thus reducing capital investment. The burner is mounted concentrically within a cylindrical chamber. Combustion products heat the liquid flowing in the annulus between burner and heat exchanger wall. Vapor escapes through a riser. This setup can be connected to a larger vessel with liquid circulated by gas-lift action of the burner.

Another type of vessel with compartmentation is said to permit controlling all factors: temperature, flow of material, and reaction time. Also, installation can be operated under vacuum or pressures up to or exceeding 100 psia.

Safety-First Blocks Trouble

Manufacturers have paid particular heed to designing burners that will operate safely.

One design delivers air and gas separately to the combustion chamber where they are mixed and burned. This avoids possibility of flashback that might occur with premixed air and gas. And the unit is further safeguarded by completely automatic controls.

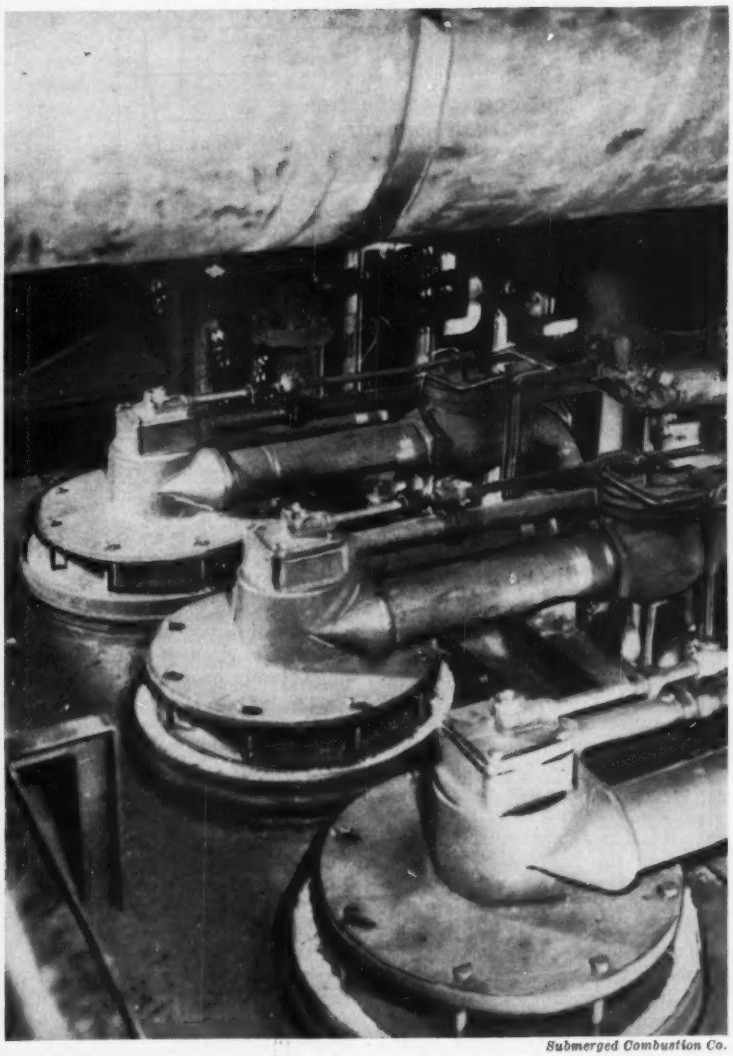
Another burner that uses premixed fuel is designed to operate from 50 to 100% of rated capacity. Outside this range the flame goes out because design of the leader tube and chamber prevents combustion at low flow.

Manufacturer of this burner considers that the greatest danger stems from attempts to light the burner with no solution in the tank. To guard against such an eventuality and as other safety precautions he provides.

- Liquid level indicators tied in with gas line to stop gas flow in event of low level.
- A flame scanner that closes a magnetic valve in the gas line and sounds an alarm if the flame fails.
- Ignition purge program that clears combustible mixture from the vessel before gas line can be reopened in the event that burner does not ignite within 15 sec.
- Thermocouples in strategic spots to close gas valve if temperature exceeds a given value.

In most commercial installations the burner is controlled by maintaining flow of air and gas in a fixed ratio to each other. Then the amount of heat released can be varied merely by throttling flow of one. Flow of the other will change automatically to hold the ratio constant.

Process variables such as temperature, pH, liquid volume or specific gravity can be held constant by varying heat release, feed rate or product withdrawal rate.



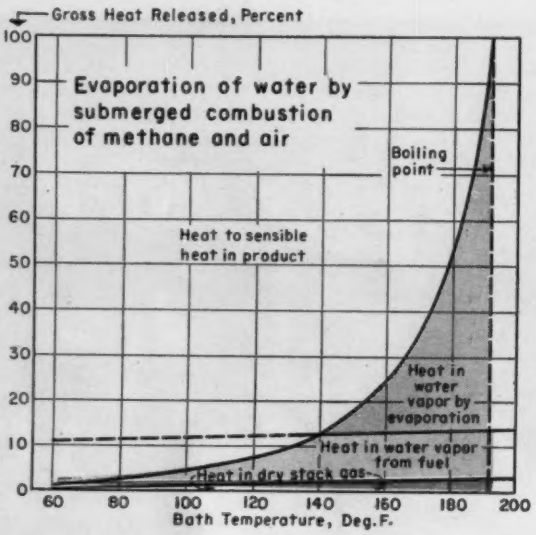
Submerged Combustion Co.

THREE burner 15-million Btu. per hr. unit concentrates ferric chloride.

A Peek Under The Surface

In tracing some of the newer applications of submerged combustion we shall backtrack a bit to describe, in some instances, how basic equipment has undergone modification to make the job go.

Heating — Straight heating equipment can be designed into a



What Happens in Submerged Combustion

An operating submerged burner discharges a hot stream of combustion products in the form of a tremendous number of exceedingly small bubbles. Representing a maximum of surface for heat transfer, these bubbles of hot gas cool rapidly to the temperature of the liquid.

At this temperature the gas within the bubbles is saturated with water vapor and the combustion products escape from the surface of the liquid in this saturated state. Total atmospheric pressure within the bubbles is the sum of the partial pressures of combustion products and volatile constituents in the bath. The useful heat in the combustion products has been yielded as sensible heat to the bath and/or as heat of vaporization for steam and other vapors.

How utilization of the heat is distributed with variation in bath temperature is shown in the curve above. A vertical line through any temperature shows the percentage of gross heat reporting in each of the several classifications.

Percentage Distribution of Gross Heat

	120 F.	160 F.	192 F.
Dry stack gas...	1.0	1.7	2.0
Water vapor from combustion ...	6.0	10.9	11.2
Water vapor from bath	...	10.9	86.8
Sensible heat in water	93.0	76.5	...

From this you can see that a large proportion of the heat input actually heats and vaporizes the water. Water-carrying capacity of the combustion products depends entirely on the vapor pressure of the water at the bath temperature, since these gases are saturated with water vapor as they leave the bath.

Below a bath temperature of 138 F. some of the water vapor produced by combustion of methane will condense in the bath. Above 138 F. water vapor from combustion does not saturate the gases so that water will evaporate from the bath to achieve saturation.

Combustion of one cubic foot of methane produces 0.10 lb. of water vapor. At 138 F. this saturates the combustion gases. At 200 F. the same quantity of dry combustion gas can carry 1.465 lb. of water vapor in addition to the 0.10 lb. derived from burning. However, because the heat from combustion of one cubic foot of methane is not sufficient to vaporize this quantity of water the bath boils at an equilibrium temperature of 192 F.

For a typical evaporation operation where some of the heat is leaving with the concentrated product, approximately 0.7 lb. of water can be evaporated per cu. ft. of 1,000 Btu. natural gas.

unit to produce high-temperature, pressurized hot water. Jefferson Lake Sulfur Co. has done it and now has a unit under construction to heat water for mining Frasch sulfur. This patented (U. S. 2,647,-370) process is scheduled to start operating early in 1956.

About 500,000 gal. per day of untreated water will be heated to approx. 325 F. and piped into the sulfur deposit. Submerged burners operating on natural gas will release 45 million Btu. per hr.

Heater gases exhaust to a 10-million Btu.-per-hr. reheater where gas flames boost temperature to 800-1,200 F. Leaving the reheater the hot gases are directed through a gas turbine. A 140-lb. compressor driven by the turbine supplies compressed air for the system.

Both stack gas from the reheater and turbine exhaust are used to preheat incoming feed water.

One decided advantage claimed for the system is ease of dismantling to transfer equipment to a new well head. Thus there's no need for insulated hot water lines running from a fixed boiler house to various well heads.

For ordinary water heating, See[1] has shown the following comparative dollar costs per million Btu.: submerged combustion, $0.621; oil-fired water tube, $1.00; gas-fired boiler, $0.924; coal-fired fire-tube boiler, $1.32; coal-fired water tube, $0.925.

Aside from the apparent cost advantage, submerged combustion for heating permits bypassing water treatment. Raw water can be used since scaling and corrosion do not interfere with the operation.

► **Concentrating**—Submerged combustion has been used rather extensively for concentrating liquors by evaporation.

Submerged combustion's unique traits have been used to good advantage for crystallizing materials with inverted solubilities, such as sodium sulfate. Also, it has been used for materials with conventional solubility characteristics. Potash Co. of America, for example crystalizes KCl by this method.

Major disadvantage of crystallizing by submerged combustion is that crystals tend to be small. However, in many cases a producer can

[1]See, Walter G., Submerged Combustion Equipment, Chemical Engineering Costs Quarterly, Oct. 1954, p. 118.

live with this characteristic because he is avoiding the scaling problems encountered in other types of equipment.

Recently a Canadian plant installed a submerged burner to concentrate caustic soda from 50 to 73% using hydrogen for fuel. Heating efficiency was 85.5% on this application. And it is entirely feasible to concentrate to a level higher than 73%. Success of caustic concentration hinges on having hydrogen available for fuel.

Much progress has been made overcoming construction problems on burners for concentrating corrosives such as sulfuric acid, phosphoric acid, calcium chloride and aluminum sulfate. Actions of the flame and hot combustion gases prevent protective films from forming, thus accelerating corrosive attack on normally resistant alloys.

One manufacturer has adopted straight graphite construction for this type of application. Since graphite is not strong enough to be suspended from the top of a tank, a ported design was developed that can be supported on the bottom of the tank. With further modifications to improve cooling of the hotter parts of the burner good service life has been obtained.

Since the first installation of a graphite burner to heat pickle liquor in 1940 a number of these units have been installed. For instance, two evaporators heated by 11-million-Btu.-per-hr. burners are concentrating calcium chloride solutions containing 1% HCl. This is part of a process to produce anhydrous HCl from muriatic acid. The $CaCl_2$ is used as a dessicating agent.

At another chemical company two-20-million-Btu.-per-hr. evaporators are concentrating wet process phosphoric acid from 28 to 54% P_2O_5 content. Courtaulds (Alabama) Inc., Mobile, Ala., uses three 24-million-Btu.-per-hr. and two 30-million-Btu.-per-hr. evaporators to concentrate rayon spin-bath liquors.

On corrosive applications vessels have been lined with suitable membranes and acid-proof brick. In wet process phosphoric acid, carbon brick usually is used to resist the hydrofluoric acid which may be present. Tank tops and vapor ducts present some design problems and materials such as Haveg and Permanite have proven useful in such applications.

An exclusive burner design that can control temperature of the exhaust gases is used successfully to concentrate whey. Here, of course, charring of the product must be avoided.

Other concentrating jobs include salt for production of table salt, latest of which is the Trace Elements Corp. 100 ton-per-month plant at Houston; concentration of potash; and concentration of waste citrus peel liquor at Texsun Citrus Exchange, Weslaco, Tex.

▶ **Reacting**—Exhaust gas from the submerged burner can be used to good advantage in chemical reactions. One installation concentrates by evaporation and also simultaneously carbonates the solution. Pepperell Mfg. Co., Opelika, Ala., utilizes the carbon dioxide in the burner exhaust to neutralize a caustic dye waste.

Also available is an automatic, push-button operated asphalt heating and oxidizing unit. It introduces heated air directly into the asphalt to step up oxidation rate. The same burner manufacturer soon will unveil systems that produce compounds at lower cost by carefully controlling temperature and time.

Water softening plants use submerged burners to recarbonate the water following the softening operation.

▶ **Purging**—Recently, burners have been used to produce inert gas for purging and blanketing operations. In the Texas oil fields water flooding operations are being developed by Gulf Oil Corp. to recover many thousands of barrels of oil not recoverable by normal procedure. But the flood water contains H_2S that precipitates iron sulfide from water in the ground to plug the formation.

A submerged combustion unit is now on this job generating inert gas to sweep the hydrogen sulfide out of water. By using combustion gas, undesirable oxygen is also kept out of the water and a desired concentration of CO_2 maintained. At 5,000 barrels per day, cost of treatment is 1.89¢/bbl.; estimated cost at 50,000 bbl./day is 0.1¢/bbl.

Two inert gas generators installed recently at Standard Oil Co. of Calif., Richmond, Calif, release 12,000 standard cu. ft. of inert gas per hour containing less than 1% total combined CO and O_2. Gas temperature can be varied by altering the flow rate of the water into which the gas is discharging.

Generators are completely explosion proof. A three-way valve on the discharge line of each unit vents to atmosphere during startup until the desired quality of inert gas is reached. Then it is cut into the product line and the unit goes on automatic operation.

If for any reason the burner stops functioning, the three-way valve discharges automatically to atmosphere so no oxygen can get into the product line. A flame monitor automatically closes down the unit and sounds an alarm in case of flame failure. Should the cooling water exceed a predetermined temperature the unit also closes down.

Heat In Big Package

While submerged burners with heat outputs of ½ to ¾ million Btu. per hr. were adequate for heating pickle liquor, by chemical industry standards these are push-cart size. One manufacturer builds burners as large as 30 million Btu. per hr. or larger, if desired. Another has built chemical industry evaporators with 26-million-Btu.-per-hr. burners. The largest multiple installation, to date, uses up to 384 million Btu. per hr. to evaporate magnesium chloride at Dow, Freeport.

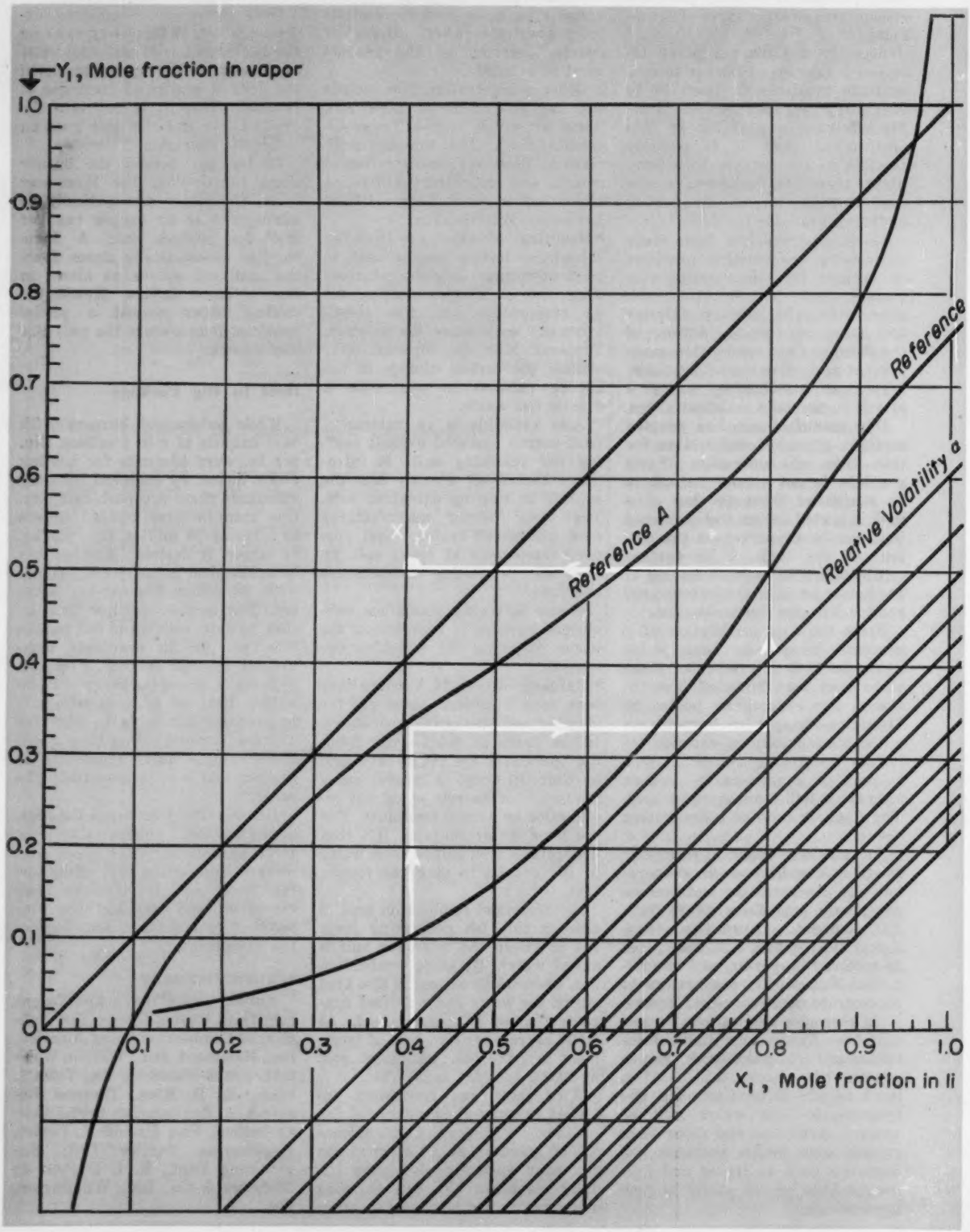
Actually, above the range of 25-30 million Btu. per hr. heat release it is probably advisable to plan for multiple burners rather than a still larger single unit. Flexibility is greater and cost is essentially the same.

But whether your needs for heat, neutralization, concentration or inert gas are large or small submerged combustion still offers low first cost. And its freedom from corrosion and scaling are unmatched by any other heat-producing equipment.

ACKNOWLEDGEMENT

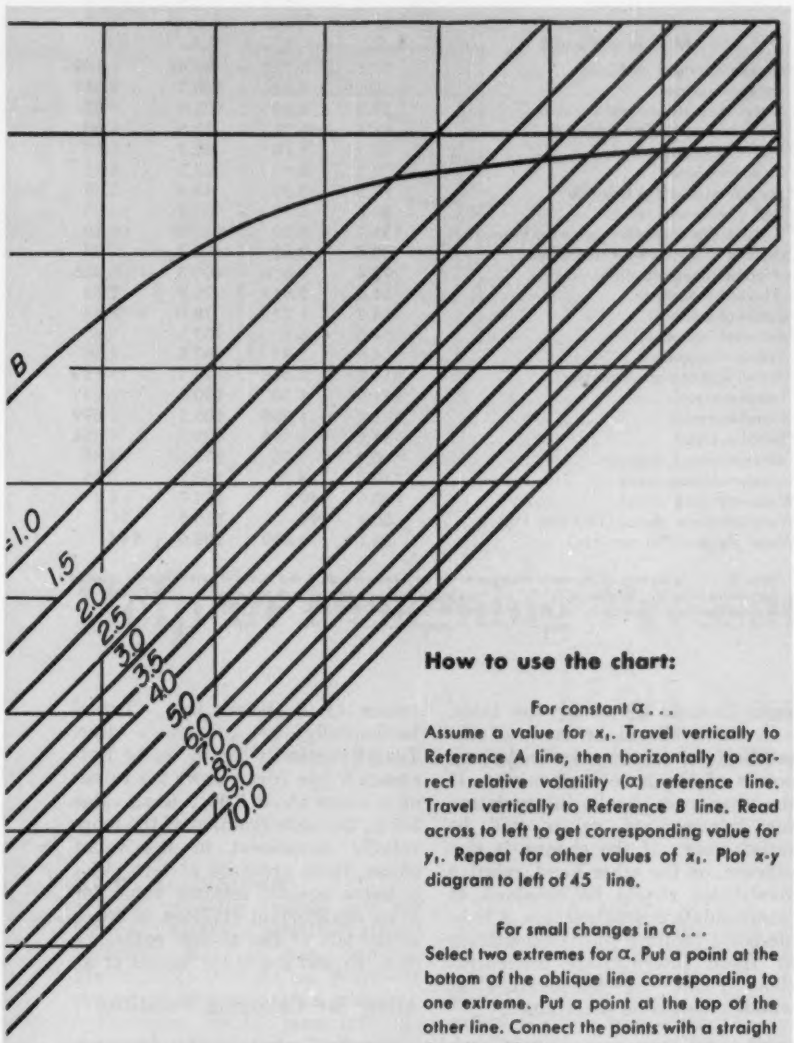
Author gratefully acknowledges help from Walter George See, Submerged Combustion Co. of America, Inc., Hammond, Ind.; William Weisman, Ozark-Mahoning Co., Tulsa 1, Okla., R. D. Ross, Thermal Research & Engineering Corp., Conshohocken, Pa.; Harold F. Porter, Engineering Service Div., Engineering Dept., E. I. DuPont de Nemours & Co., Inc., Wilmington, Del.

Plot Vapor-Liquid Equilibrium



Diagrams Faster

By NORBERT N. BUCHSBAUM, Lummus Co.



How to use the chart:

For constant α . . .

Assume a value for x_1. Travel vertically to Reference A line, then horizontally to correct relative volatility (α) reference line. Travel vertically to Reference B line. Read across to left to get corresponding value for y_1. Repeat for other values of x_1. Plot x-y diagram to left of 45 line.

For small changes in α . . .

Select two extremes for α. Put a point at the bottom of the oblique line corresponding to one extreme. Put a point at the top of the other line. Connect the points with a straight line. Use this line as the α reference line to determine values of y_1.

For large changes in α . . .

Assume three of four values of x_1. Travel vertically from each to Reference A line, then, horizontally to corresponding lines. Connect the intersection points with a smooth line. Use this line as the α reference line to determine values of y_1.

quid

If you have a problem in binary distillation, use this chart to quickly construct a vapor-liquid equilibrium curve without calculation.

IN THE early stages of designing equipment to separate the components of a binary mixture by distillation the chemical engineer will plot a vapor-liquid equilibrium diagram. He will use this plot, then, to determine the number of theoretical plates required to obtain a given separation and the reflux ratios to employ.

If experimental x-y data are at hand the engineer will construct the equilibrium diagram directly from them. In their absence, however, he must calculate values of y, for selected values of x, from the relative volatilities of the components.

A chart has been developed to speed up this process, a chart which permits the graphical determination, from relative volatilities, of vapor-liquid equilibrium diagrams for binary mixtures. It permits construction of the complete equilibrium curve without any calculation.

The chart easily accounts for changes in relative volatility with composition and obtains a smooth continuous x-y curve which at every point is a function of the correct value of α. The x-y curve can be plotted directly on the upper left-hand corner of the chart.

First, Get Relative Volatility

The relative volatility measures the ease of separation of two components from a liquid mixture:

$$\alpha_{1\text{-}2} = [y_1/x_1][x_2/y_2] = K_1/K_2 \quad (1)$$

where K = equilibrium constant; x = mole fraction of one component in the liquid phase; y = mole fraction of one component in the vapor phase; and α = relative volatility. Subscripts 1 and 2 respectively refer to the more and less volatile component.

Noting that in a binary mixture

$$x_1 + x_2 = 1 \quad (2)$$

$$y_1 + y_2 = 1 \quad (3)$$

Eq. (1) may be rearranged. Substituting therein Eqs. (2) and (3), the well-known expression for y_1 in terms of α and x_1 is obtained:

$$y_1 = \alpha x_1/[1 + x_1(\alpha - 1)] \quad (4)$$

Eq. (4) thus permits the calculation of the complete vapor-liquid equilibrium diagram, provided the relative volatility, α, is known.

Members of homologous series, isomers and certain other mixtures closely approach ideal solutions. The table on p. 170 shows a number of such mixtures. If an ideal solution may be assumed, in which Raoult's law applies, we have:

$$p = P^\circ x = Py \quad (5)$$

from which

$$y = P^\circ x/P \quad (6)$$

where p = partial pressure of one component in equilibrium with the mixture; P° = vapor pressure of the pure component; and P = total pressure of the system.

Substituting Eq. (6) into (1):

$$\alpha = [P_1^\circ x_1/Px_1]\,[Px_2/P_2^\circ x_2] = P_1^\circ/P_2^\circ \quad (7)$$

Thus for ideal solutions the relative volatility, α, is equal to the ratio of the vapor pressures of the pure substances. This ratio of vapor pressures varies with temperature and, since the boiling temperature of the mixture varies with composition, conditions of constant relative volatility do not usually prevail. This is shown by the table.

Relative Volatilities of Ideal Mixtures

Mixture of 1 and 2	B.p. of 1, C.	P_1°/P_2°	B.p. of 2, C.	P_1°/P_2°
Benzene-ethylene dichloride	80.1	1.113	83.48	1.109
Benzene-toluene	80.1	2.61	110.7	2.315
n-Butyl chloride-n-butyl bromide	77.5	2.08	101.6	1.87
Chloroform-carbon tetrachloride	61.1	1.71	76.6	1.60
Ethanol-isopropanol	78.3	1.18	82.3	1.17
Ethanol-propanol	78.3	2.18	97.2	2.03
Ethyl chloride-ethyl bromide	12.5	3.23	38.4	2.79
Ethyl ether-benzene	34.6	5.16	80.2	3.95
Ethylene dibromide-propylene dibromide	131.7	1.30	141.5	1.30
Ethylene dichloride-trichloroethane	83.5	2.52	113.7	2.33
n-Heptane-methylcyclohexane	98.4	1.058	100.3	1.056
n-Hexane-n-heptane	69.0	2.613	98.4	2.33
Methanol-ethanol	64.7	1.73	78.1	1.64
Methanol-isobutanol	64.6	6.1	107.5	4.4
Methanol-propanol	64.6	3.89	97.2	3.15
Methyl acetone-ethyl acetate	56.8	2.036	77.1	1.923
Phenol-o-cresol	181.2	1.30	190.6	1.275
Phenol-m-cresol	181.2	1.768	201.5	1.699
Phenol-p-cresol	181.2	1.793	202.2	1.728
Toluene-benzyl chloride	110.7	7.75	178.0	4.45
Toluene-chlorotoluene	110.7	4.76	162.0	3.65
Water-ethylene glycol	100.0	49.8	197.0	13.2
Water-ethylene glycol (150 mm. Hg)	60.1	98	150.2	21
Water-glycerol (50 mm. Hg)	38.1	76,400	202.0	244

Note: P_1°/P_2° is the ratio of the vapor pressures of the pure components, 1 and 2, and is approximately equal to α, the relative volatility. Values of P_1°/P_2° are those at the boiling points of each component. From Perry, J. H., "Chemical Engineers' Handbook," p. 526, McGraw-Hill Book Co., Inc., New York, 1950.

NORBERT N. BUCHSBAUM, a process engineer with Lummus, has worked on chemical and petrochemical plant design since joining the company in 1953. Born in Vienna, Austria, Buchsbaum came to the U. S. in 1947, attended evening classes at Cooper Union and graduated in 1953 with a BChE. He is a member of the AIChE.

A check should be made of the relative volatilities at the boiling points of the pure components. If the change is small, interpolation for intermediate values will be satisfactory. If the change is significant, on the other hand, relative volatilities should be obtained at intermediate concentrations. A bubble-point (boiling point) calculation at these intermediate concentrations yields the temperature at which α should be determined.

How to Use the Chart

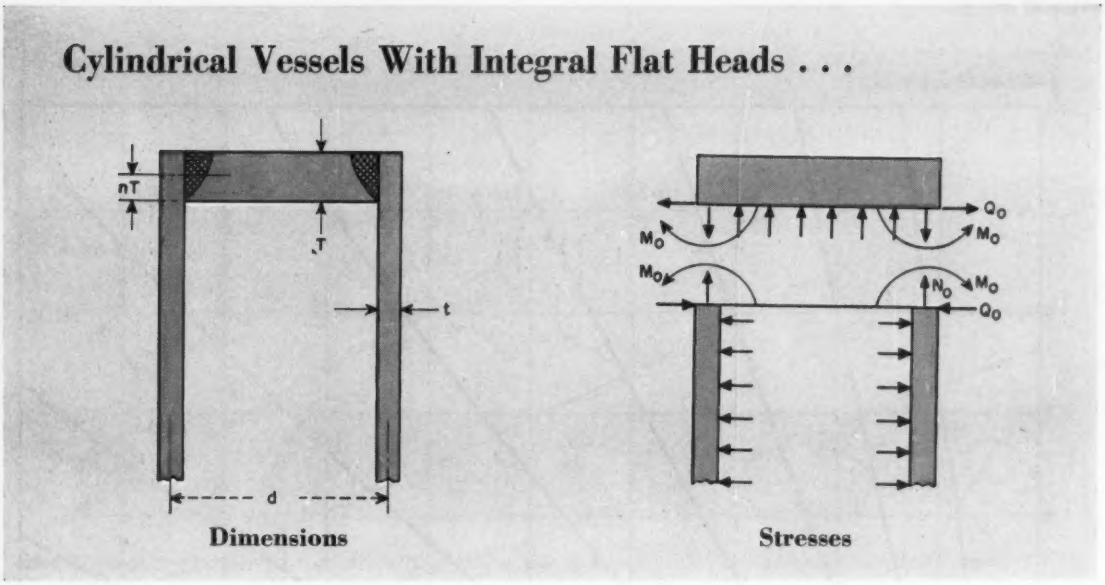
The series of oblique lines extending down from the upper right corner of the chart represents relative volatilities from 1 to 10. Intermediate lines may be obtained by interpolation. Conditions at the top of the distillation column (high concentration of more volatile component) are represented by α in the upper region of each of the oblique lines. The lower region of each line relates to conditions at the bottom of the column.

To use the chart follow this step-by-step procedure: Select a value for x_1, the mole fraction of the more volatile component in the liquid phase. Travel vertically up to Reference A line (draw down for values of x_1 below 0.1). Travel horizontally to correct α line. Travel vertically again up to Reference B line (draw down for values of x_1 above about 0.96). Read value for y_1, the mole fraction of the more volatile component in the vapor phase, from ordinate at left. Plot y_1 value against selected value for x_1 on equilibrium diagram in space at the left of the 45-deg. reference line. Repeat for other values of x_1.

Allow for Changing Volatility

For small changes of α from top to bottom of the column it will usually be satisfactory to locate the respective values for α in the upper and lower regions, one for each, (actually, at the upper and lower ends of the oblique lines) and to join these by a straight line. This new line should be used to help construct an x-y diagram.

Large changes in α should be handled as follows: Travel vertically from an assumed value for x_1 to Reference A, then horizontally to locate a point on the corresponding value of α. Repeat for several other values of x_1 and corresponding values of α which prevail at those concentrations. Connect the resultant points by a smooth line and use it to help pick off values of y_1.



Help in Designing Pressure Vessels

If you design or use vessels with flat heads, you'll find this rapid graphical method of estimating maximum stresses accurate enough to justify use of minimum safety factors.

R. W. SCHNEIDER

Most pressure vessels are designed by means of relatively simple formulas. Many of these formulas are inexact; they do not represent the actual stresses in the vessel.

Formulas which take into account the actual stress intensification due to the geometry of the particular vessel can get quite complicated. Many of the simplified design formulas thus contain terms or factors which partially compensate for local stresses. Use of such factors has been inspired by the desire to simplify the design calculations and has been backed up by the cumulative experience of design engineers in the pressure vessel field.

R. W. SCHNEIDER *is with the Engineering and Loss Control Division of Travelers Insurance Co., Hartford, Conn. He is a chemical engineering graduate of Lehigh University.*

The trend today, however, is toward more exact calculation of stresses in pressure vessels. Close attention to design details will permit the use of lower factors of safety and new high-strength, low-ductility alloys (see *Chem. Eng.*, Nov. 1955, pp. 130, 132).

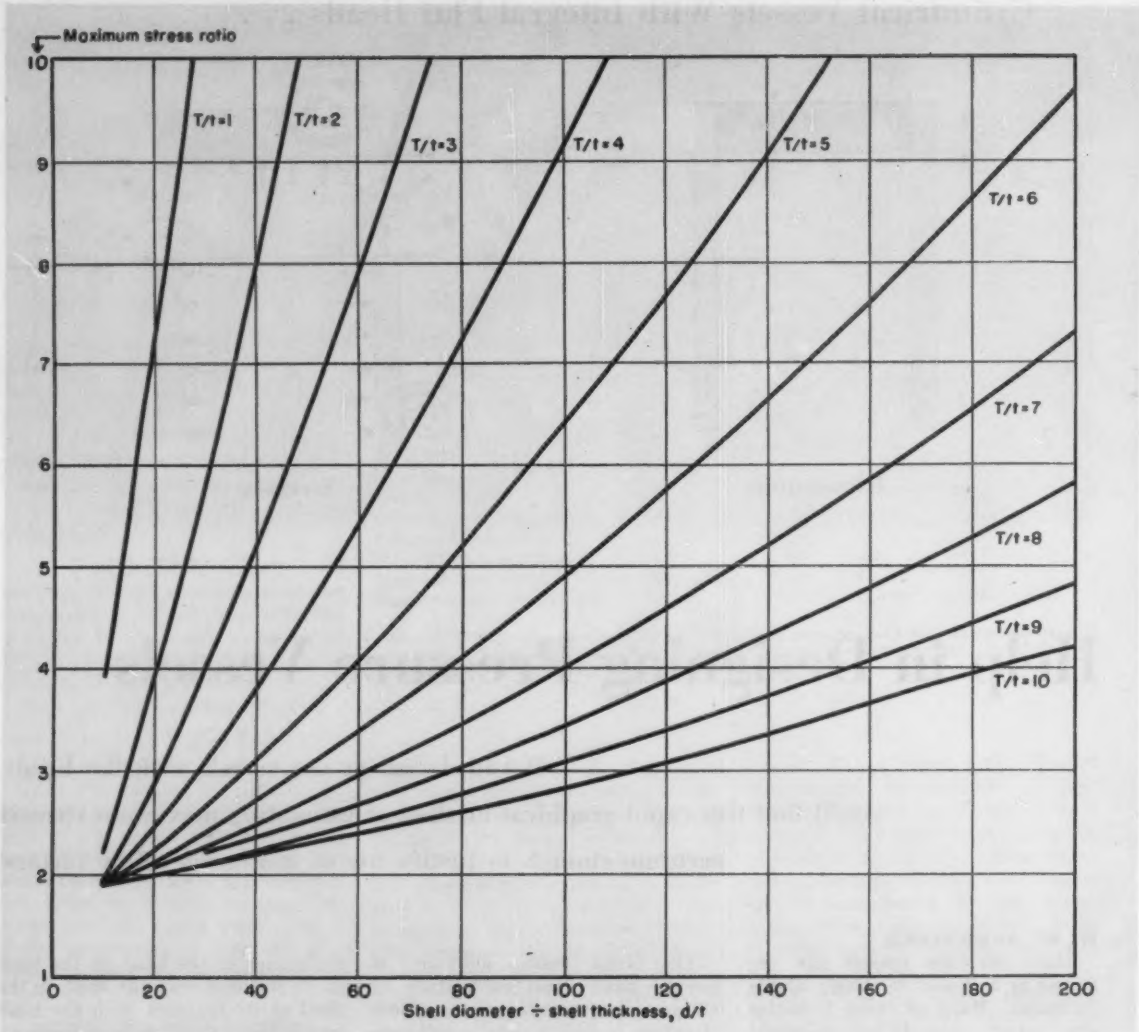
As this trend progresses, designers will have to use more complex formulas. They will welcome new graphical methods for rapid solution of these formulas, such as the method presented here.

A simple type of vessel construction, yet one whose stress analysis can get quite involved, is the cylindrical shell with an integral flat-head closure. We may consider the head as integral with the shell if the head and shell are made from a single part or if the head is welded to the shell.

There are four locations in the vicinity of the closure where the stresses may be of consequence—in the center of the head, in the head at its junction with the shell, in the shell at its junction with the head and in the shell away from the junction. At each location three significant stresses exist—circumferential, axial and shear.

These stresses have been studied by Watts and Lang (*Trans. ASME*, **74**, 1083-1091, 1952). Although their analysis is long and involved, Watts and Lang demonstrated that the maximum stress occurs at the junction, is axial in direction and may be either in the head or in the shell. The maximum axial stress is in the *head* at the junction when the head-shell thickness ratio T/t is 1.0 or less; for thickness ratios over 1.0 the maximum stress occurs in the *shell* at the junction.

Since T/t in most practical vessel designs is more than 1.0, we can usually design on the basis of axial stress in the shell. Let us represent this stress in dimensionless form



by dividing it by $pd/2t$, the familiar expression for circumferential stress in a thin-walled cylinder under internal pressure only. We'll call this dimensionless term the "stress ratio."

In a discussion published at the end of the Watts and Lang paper, Wesstrom offered a formula which applies to the calculation of the axial stress ratio in the shell at its junction with an integral flat head. This formula is:

$$\text{Stress ratio} = 0.5 + W/Z$$

in which

$$W = C_1a^3 - 2C_2na + C_3b^{1.5} + 2C_4nab + C_5b/a$$

$$Z = C_6a^3 + 2C_7na + C_8/a + C_9b^{0.5} + 4C_{10}n^3a^3/b^{0.5} + C_{11}a^2/b^{0.5}$$

Based on steel construction, the constants are:

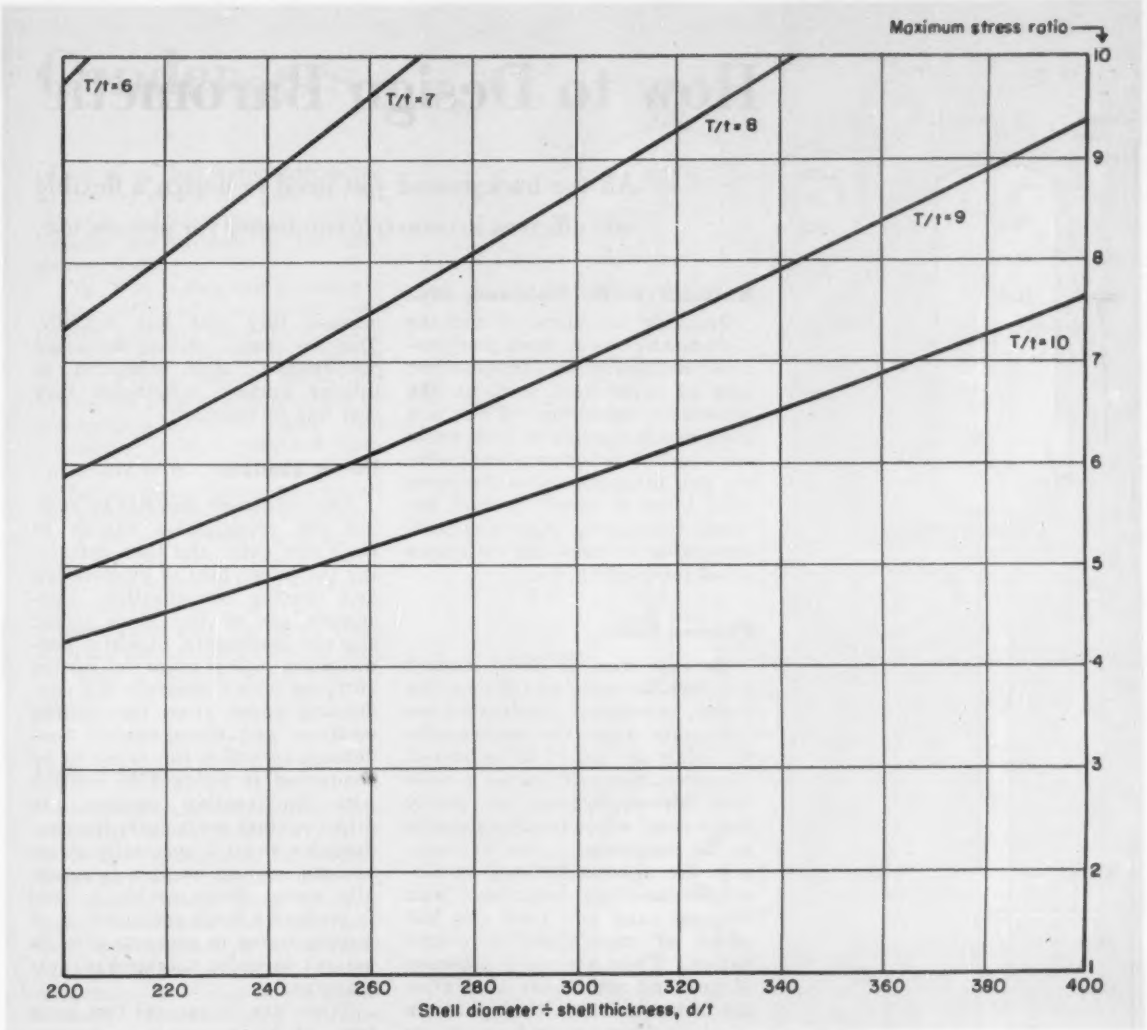
$C_1 = 2.94317$
$C_2 = 3.74071$
$C_3 = 1.00000$
$C_4 = 0.908912$
$C_5 = 0.385077$
$C_6 = 1.90702$
$C_7 = 4.84761$
$C_8 = 1.026862$
$C_9 = 2.66667$
$C_{10} = 4.40610$
$C_{11} = 1.46869$

The above charts give a graphical solution to the Wesstrom formula for T/t ratios greater than 1.0. Since the formula does not apply for $T/t = 1.0$, the curve for this condition, referring to the stress ratio in the head rather than the shell, is based on data from Watts and Lang. The term n has been taken at 0.50.

We may use these charts to find maximum stress ratio or stress when a design has already been established, or we may determine the head or shell thickness when it is desired to fix the stress ratio at a particular upper limit. We assume that the vessel diameter is fixed, which is usually the case.

Here are two problems illustrating use of the charts:

Problem I—Determine the maximum stress in the vicinity of an integral flat-head closure when the mean shell diameter $d = 20$ in., shell thickness $t = 0.25$ in., flat head thickness $T = 1.0$ in., pressure is



50 psi. and the material is steel. Where is this maximum stress?

$$d/t = 20/0.25 = 80$$
$$T/t = 1.0/0.25 = 4.0$$

From the chart, maximum stress ratio = 7.25. Maximum stress therefore is

$$7.25pd/2t = (7.25)(50)(20)/(2)(0.25) = 14{,}500 \text{ psi.}$$

This stress occurs in the cylinder at the junction of the cylinder with the head; it is axial in direction.

Problem II—A steel pilot-plant reactor is to be made of 12-in. Schedule 30 steel pipe with flat-head closures. Based on design pressure of 200 psi. and maximum allowable stress of 18,000 psi., will the shell be heavy enough? What should be the minimum thickness of the heads?

First check the circumferential stress in the shell:

$$pd/2t = (200)(12.42)/(2)(0.330) = 3{,}770 \text{ psi.}$$

Since this is well below the maximum allowable stress of 18,000 psi., proceed with calculation of head thickness.

$$d/t = 12.42/0.330 = 37.7$$

$$\text{Maximum stress ratio} = 18{,}000/3{,}770 = 4.77$$

From the chart, T/t is between 3.0 and 4.0, with an estimated value of 3.1. Therefore,

$$T = (3.1)(0.330) = 1.02 \text{ in.}$$

NOMENCLATURE

a	T/t
b	d/t
C	Constant
d	Mean diameter of shell, in.
M_o	Bending moment per unit length of circumference exerted by head on shell
n	fraction of T equal to distance from the midplane of the head thickness to the joint; positive when the joint is on the same side as the shell
N_o	Axial force per unit length of circumference acting on shell
p	Internal pressure, psi.
Q_o	Shear force per unit length of circumference exerted by head on shell
t	Thickness of shell, in.
T	Thickness of integral flat-head closure, in.

How to Design Barometic

All the background you need to design a flexible and efficient barometric condenser for process use.

HARLAN HOW, Maitland, Fla.

Probably no piece of process equipment gives as much performance, in terms of heat transfer per unit of investment cost, as the barometric condenser. There is a good reason for this in that, while construction is comparatively simple and inexpensive, at the same time there is direct contact between condensing vapor and cooling water without the resistance of an intervening wall.

Process Uses

Because there is direct contact between the vapor and the cooling water, barometric condensers are used only where the condensable materials are not to be recovered. However, this still leaves a wide field for application, at nearly every point where process steam is to be condensed. For example, they are universally used to condense the steam vaporized from vacuum pans and from the last effect of multiple-effect evaporators. They are used between stages and sometimes also after the last stage of multi-stage steam ejectors. They are used on vacuum distilling columns to condense the process steam.

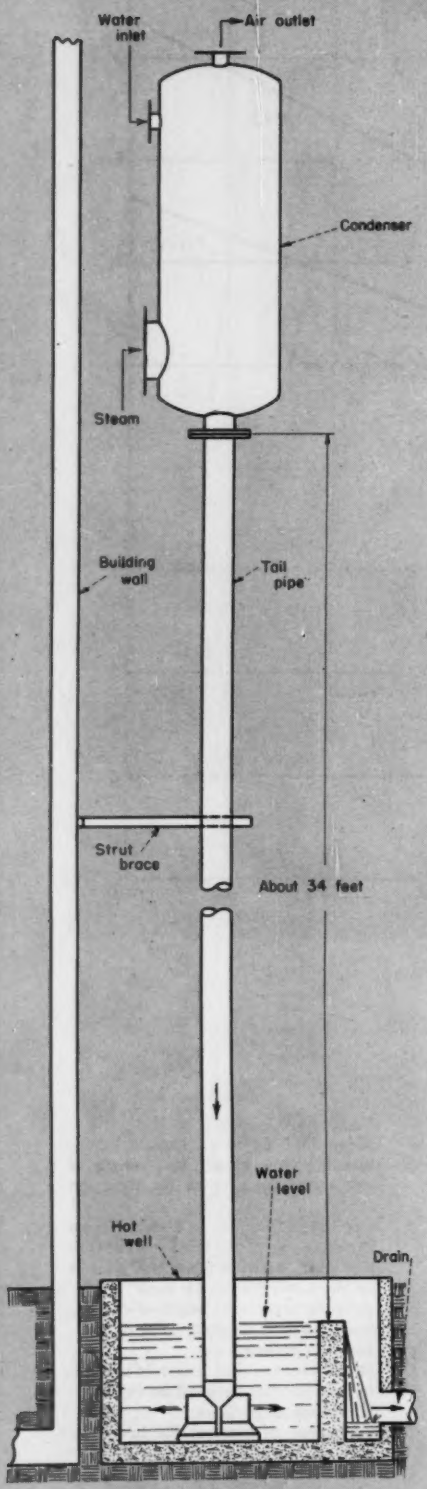
Barometric condensers are used where it is desired to create a vacuum in a piece of process equipment from which both condensable vapors and non-condensable gases are being evolved. In the usual applications the proportion of condensables to non-condensables is large. It would be possible to create the necessary vacuum without the condenser by using a sufficiently large vacuum pump, but use of the condenser reduces the vacuum pump load to a value not much above that of the non-condensables alone.

Barometric condensers are used because they cost less initially. They are simple, offering decreased obsolescence. And compared to tubular surface condensers they cost less to maintain.

Direct Contact

Any condenser operates by cooling the condensable vapors to their dew point and then extracting the latent heat of evaporation and causing condensation. Condensers are of two main types: surface condensers, in which condensation takes place on cooled surfaces which separate the condensing vapor from the cooling medium; and direct-contact condensers in which the vapor to be condensed is brought in contact with the cooling medium. In direct-contact condensers the condensable vapor is generally steam and the cooling medium is generally water. Some device is used to produce a large surface area of cooling water in proportion to its volume in order to expedite heat transfer.

There are in general two main types of direct-contact condenser: the low-level condenser, and the barometric condenser. In the low-level type a pump must be provided to pump the cooling water and the condensate from the condenser. This requires that the water be pumped up from the reduced pressure of the condenser to atmospheric pressure. In the barometric condenser the discharge pump is eliminated by elevating the condenser body 34 ft. or more above the water discharge point in the hot well, and providing a barometric leg or tail pipe from the bottom of the condenser body to the hot well. A tail-pipe height of 34 ft. of water corresponds approximately to a pressure



TYPICAL arrangement for barometric condenser eliminates need for pump by discharging condensate down barometric leg into hot well—(Fig. 1)

Condensers

of 1 atm. so that water introduced at the top of the tail pipe will fill the pipe and flow from the bottom, despite the vacuum in the condenser body.

Fig. 1 is a diagram showing a typical set-up of a barometric condenser, together with its tail pipe and hot well. The hot well serves both as a liquid seal for the bottom of the tail pipe and as a means of discharging the warm water. The condenser is also provided with vapor and water inlets and an outlet for the non-condensables which are withdrawn from the condenser by a vacuum pump such as an ejector. One type of barometric condenser which will be discussed later has the ability to entrain the condensables and discharge them with the effluent water and so does not need a vacuum pump and air outlet.

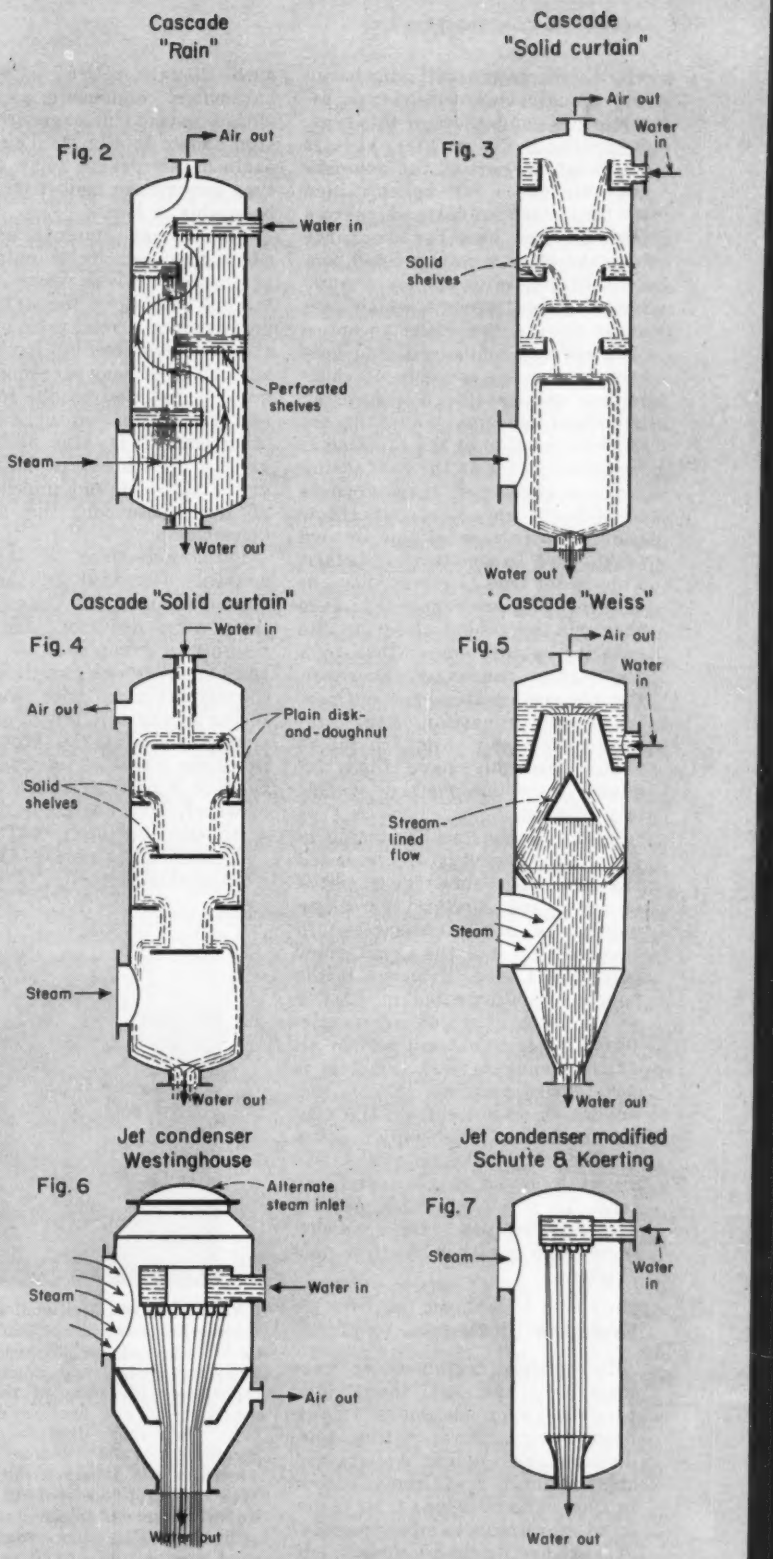
Flow Patterns

Several arrangements have been used for water flow through a barometric condenser. In general, these may be classed as free-fall and nozzle-jetted. In a free-fall type of condenser the water may flow in a number of interrupted steps as in the so-called cascade condenser—or it may fall in a continuous, uninterrupted stream from the distributor at the top of the condenser to the discharge.

Another distinction in flow method in free-fall condensers is whether the water forms a continuous curtain which must be penetrated by the condensing steam, or whether it falls in a number of continuous solid streams, or as drops.

In addition to free-falling water, a number of types of condensers have used water either sprayed or jetted through nozzles. The spray type appears to have no advantage and has largely disappeared, due mainly to the difficulty of keeping fine spray nozzles from clogging. Condensers using solid

FLOW through condenser may be free-fall or nozzle-jetted.—(Fig. 2-7)



jetted streams generally discharge into a conical or venturi-type receptor. In condensers of this type, depending on design, all or at least a substantial part of the non-condensable gases can be entrained by the jetted water and carried into the tail pipe for discharge with the effluent water. Such condensers generally employ a number of jetted streams which converge toward the outlet receptor.

In surface condensers and heat exchangers, the concepts of counterflow and parallel flow have an important meaning, and influence on the operation of the equipment. However, so far as the condensing vapor is concerned, there appears to be no evidence that counterflow is superior to parallel flow, or vice versa, in a barometric condenser. This is not true so far as the non-condensables are concerned, since they can be cooled closer to the entering water temperature in a counterflow condenser. However, the non-condensables are ordinarily a small proportion of the total condenser load and therefore should probably have little influence on which method of flow is preferred.

In the condensers illustrated in Figs. 2 through 5 it will be noted that the water flow (by gravity) is downward, against the rising vapor and non-condensables. In these condensers the counterflow principle is used. However, in the condensers illustrated in Figs. 6 and 7 (both of which use nozzle-jetted water to entrain part or all of the condensables) the flow is necessarily parallel. In condensers which do not entrain the non-condensables, the only consequence of parallel operation is a slight increase in vacuum pump load. In those which do entrain non-condensables, the vacuum pump load is either small or non-existent.

Evolution of Designs

Barometric condensers have been built and used industrially for well over 50 years. Hausbrand's book, "Evaporating, Condensing and Cooling Apparatus," appeared in its first German edition in 1900. The book was later translated into English and appeared in at least five English-language editions, through 1933. The earliest edition dealt clearly and at length with the theoretical aspects of barometric condensers, as well as with a successful commercial design shown in Fig. 2. This is the earliest fair design for a cascade type barometric condenser I have been able to locate.

This design employs a "rain" effect produced by a number of perforated shelves which also interrupt the fall of the water. The design gives a good ratio of water surface to volume, but has the disadvantage of easy plugging of the holes in the shelves due to debris and the formation of corrosion tubercles. It is also probable it gives a high pressure drop owing to the tortuous and impeded path of the steam and the non-condensables.

Later variations of this same general idea, that is, the interrupted cascade, are found in contemporary designs. Fig. 3 is roughly a composite of several contemporary designs. It operates countercurrently, with water entering at the top, steam and non-condensables at the bottom. Its principle is that of the interrupted cascade with continuous curtains of water. This design, in one form or another, has been used for over 20 years and appears to have worked satisfactorily.

HARLAN HOW, Maitland, Fla., is an equipment design consultant who until 1953 served for 30 years in engineering design and administrative capacities with many of the leading concerns in the process equipment field, including Buffalo Foundry, Struthers Wells, Dravo, General American and Jeffersonville Boat. In 1943 he first assisted in building Koppers' huge butadiene-styrene plant at Kobuta, Pa., after which he was chief engineer of the Butadiene Division, in charge of engineering design, and construction.

Its disk-and-doughnut arrangement of baffles is a common one and occurs in another, further simplified variation in Fig. 4. Lacking published performance data I doubt whether any of the variations of this idea show significant improvement in either performance or capital cost.

One adverse comment on this design is that it is more complex than necessary. As a further simplification, Weiss' design dating from the early 1920s, and shown in Fig. 5, may be cited. This design streamlines the ordinary disk-and-doughnut arrangement but, along with Figs. 3 and 4, it suffers from the disadvantage of excessive pressure drop due to its use of continuous curtains of water which must be penetrated by the vapor and non-condensables.

The design of Figs. 2-5 are all countercurrent. The two jet-type condensers shown in Figs. 6 and 7 depend on parallel flow. In both, the steam and non-condensables enter at or near the top and flow with the water toward the tail pipe.

The condenser of Fig. 6 is a Westinghouse design of the 1920's described in Webre and Robinson's "Evaporation" published in 1926 by Chemical Catalogue Co. It will be noted that the jets from the nozzles converge toward the water outlet at the tail pipe. There the non-condensables are entrained, part passing to the air discharge under the cone, the remainder being carried out with the water through the tail pipe. The water velocity at this point is high enough to prevent upward release of the air. A characteristic of this condenser is the shortness of the body compared to its diameter, and the high velocity of the cooling water jets. It is not necessary for water to be pumped under positive pressure to this condenser, since, once it gets into operation and vacuum is established, the water supply pressure may be reduced to a point well below atmospheric.

Fig. 7 is a simplified variation of a 1930 Schutte & Koerting design which was given the name of Multi-Jet condenser. Here the nozzles are directed toward a venturi discharge and the entrainment effect is sufficient to evacuate all the fixed gases through the tail

pipe. Although ejector condensers of this type have been claimed to require more water than cascade types and to be subject to nozzle clogging by debris, it seems unlikely that either objection would hold today with proper care and operation.

A number of other variations have been used from time to time in barometric condenser design, but most of these seem not to have added anything to the art and many of the fancied improvements have disappeared entirely. Thus it is unnecessary to consider them.

There is no doubt that many successful condenser designs have been developed in the past. It appears that the only probable path for improvement is to compare the features of these various designs, select what is best from each, and finally develop a simplified design which will be inexpensive to build, and effective in operation. We shall later discuss such a design which depends on the use of continuous streams of water, flowing by gravity from a notched distributor near the top, and falling without interruption to the bottom discharge.

Barometric Condenser Design

In designing a barometric condenser, it is well to bear in mind that the condenser is normally placed at the end of a train of operations which may themselves give variable and unpredictable results. For example, a condenser is used to help evacuate the last effect of a multiple-effect evaporator. Variations of steam fed to the first effect are reflected in evaporation variations from the last effect, thus changing the quantity of heat flowing to the condenser. Hence the condenser cannot be designed for a definite and invariable load, but must be designed for flexible operation at levels both above and below the design point.

It is clear, therefore, that designing too close may lead to trouble in using a condenser, and it is therefore wiser to overdesign. This does not mean a careless regard for economy. Rather, it means that, in the face of a number of unpredictable variables, the condenser must nevertheless be large enough to compensate for shortcomings in the design or operation of the equipment which precedes it.

To consider how a barometric condenser should be designed, let us first consider what the condenser's job is. In the first place, it must be able to absorb the sensible heat of the incoming vapor above a certain temperature level, then condense this vapor by absorbing its latent heat at this level. At the same time it must cool the noncondensables to substantially the same temperature. Thus the variables, assuming steam as the vapor, are: (1) quantity of sensible and latent heat to be absorbed from the steam; (2) sensible heat to be absorbed from the non-condensables; and (3) temperature and quantity of cooling water to be used.

Unfortunately, as we dig into the meager literature on barometric condenser design (e. g., Chave, *Chem. Met. Engr.*, Apr. 1936, pp. 190-95) we find that what little theory has been developed is largely unsupported by actual data. We are able to test our theories inductively or qualitatively, but we have little quantitative support based on reliable data.

Hausbrandt recognized qualitatively that, since heat is transferred to the water from the condensing steam by way of the water surface, then the more water surface there is available in proportion to its volume, the more rapid will be the heat transfer at a given temperature difference. He pointed out that, to give a large water surface, it might be flowed over solid surfaces; allowed to fall in plain or curved sheets, contacting the steam on both sides; it might be poured or squirted into the condenser in streams; or it might be sprinkled into the condenser in the form of drops.

So far, so good. However, Hausbrandt considered that a free fall of water within a reasonably sized condenser shell would not give sufficient time of contact for condensation, and so he introduced the idea of interrupting the fall by means of a cascade arrangement. Actually, rough, practical tests have shown that water will take up the latent heat of steam, condensing it up to a point where water temperature approaches the saturation temperature of the steam, and do this as rapidly as one can bring them together. The conclusion therefore is that water falling downward in an unimpeded path does the job as well, if not better, than a method which attempts to delay the passage of the cooling water by cascade steps.

Hausbrandt used a "rain" effect produced by perforated trays in his cascade. However, later designs using solid trays have substituted continuous curtains of water through which any vapor uncondensed on first contact, and all noncondensables, must pass. The idea is that the steam should be forced into more intimate contact in rupturing the water curtains, but this viewpoint is debatable. Certainly, condensers using separated water streams are effective. Furthermore, the pressure drop of the steam through a continuous water-curtain unit can be as much as 1 in. Hg. At reasonably high vacuum this can make a material difference in the capacity of an evaporator or still to which such a condenser is attached. It appears, therefore, that a discrete-stream condenser is preferable to a continuous-curtain condenser.

We have already taken note of the fact that whether operation is countercurrent or parallel makes no difference in a barometric condenser, so far as the condensing of the steam is concerned. Furthermore, since the non-condensable load is a small part of the total load, the influence of the non-condensables can be disregarded from this standpoint. We can conclude, therefore, that our condenser may be either countercurrent or parallel, depending on convenience or preference.

We have now examined a number of successful designs, and we have arrived at several general principles. We have not, however, arrived at any quantitative data. For design purposes we can assemble enough such information from past experience and from a comparison of earlier designs.

For example, the problem of determining the quantity of noncondensables that must be handled is a very difficult one. Air and other gases may be released from the process materials, they may be given off from solution, or they may come from leaks in the system. A rough rule allows 5 lb. of free air at atmospheric pressure for each 1,000 lb. of steam condensed. This figure is based on probable leakage

through faulty joints. It is possible to reduce it; but it may be higher, especially when non-condensables arise from causes other than leakage.

Another factor from experience is the "approach" that can be expected. A well-designed and well-operated barometric condenser can discharge its cooling water heated to a temperature within 5° F. of the entering steam. Under poorer conditions of operation, an approach of 10° may be anticipated.

A System for Design

In addition to the location of vapor, water and air connections, and the internal arrangements for distributing the water, there are seven main factors to be considered in the design of a barometric condenser. These include:

1. Vapor pipe diameter
2. Water inlet diameter
3. Tail pipe diameter
4. Air outlet diameter
5. Body diameter and length
6. Body metal thickness and corrosion allowance
7. Hot well size and capacity.

The system described here starts with the quantity and condition of the steam to be condensed. Assume that we wish to condense 12,500 lb./hr. of saturated steam at 27 in. Hg. vacuum. The available cooling water temperature is 80 F. The temperature of saturated steam at this pressure is 115 F. and its latent heat is 1,027 Btu./lb.

1. From the steam flow rate in Table I find the required vapor pipe diameter. Inspection of Table I shows that a 20-in. vapor pipe should be selected.

2. From the Btu. content of the steam, calculate the quantity of cooling water needed to absorb this heat, assuming a 5° approach.

The water needed to cool the non-condensables can ordinarily be disregarded. From the water rate required and Table II, find the water inlet diameter.

Since cooling water can be heated within 5 F. of the steam temperature (5° approach), therefore water temperature rise is (115-5) − 80 = 30 F., equivalent to 30 Btu./lb. Water needed = (12,500 × 1,027)/30 = 427,900 lb./hr. or 427,900/(8.33 × 60) = 856 gpm. A simplified "quickie" system, substituting 1,000 Btu. for the true latent heat of the steam and 500 for the accurate factor (8.33 × 60) is

$$\text{Water needed} = \frac{12{,}500 \times 1{,}000}{30 \times 500} = 833 \text{ gpm.}$$

The "quickie" method is easy enough for mental arithmetic and usually accurate enough since the actual condenser duty may not be known precisely.

Now from Table II select the water pipe as 8-in. to allow for 833 gpm., or thereabouts.

3. From the water inlet size, select the tail pipe size. The tail pipe can be chosen the same size as the water inlet if the latter is 4 in. or larger. If the water inlet is 3 in. or smaller, select one pipe size larger for the tail pipe. In this case, use an 8-in. tail pipe.

4. Choose the air outlet pipe size. This is largely a matter of judgment. We have noted the rough rule of 5 lb. of free air per 1,000 lb. of steam. Usual air outlet sizes range from 2 in. on smaller condensers to say 6 in. on very large condensers, e.g., with a 30-in. vapor pipe. Select a 4-in. pipe here.

5. Ratios of condenser body dimensions in existing successful designs can be used as an approximate guide in choosing the condenser diameter and length. In studying existing designs we find a more or less constant ratio of vapor inlet diameter to condenser body diameter. In three designs being built today, the ratio is respectively 62, 62 and 57%. These designs exhibit a less constant ratio of condenser shell diameter to length. The ratios in this case are respectively 25, 29 and 19%. These data apply to both cascade and jet-type condensers.

Moreover, considering that there is inevitably a time factor, however short, in transferring the heat within the condenser body, it appears that the idea of a fixed ratio between body diameter and length cannot be taken too seriously. If this were the case, a small condenser might have only half the length of water fall of a condenser of twice the diameter. So the use of established length/diameter ratios may require a little judgment.

From the facts noted we may conclude that a vapor pipe diameter-body diameter ratio of about 5:8 is reasonable. Customarily body length would be 3 to 5 times the diameter, although in the design later advocated by the author, a

Vapor Pipe Sizes for Various Steam Flow Rates[1]—Table I

Pipe Size, I.P.S., Inches	Steam Flow Rate at 26 In. Vac., Lb./Hr.[2]	Steam Flow Rate at 27 In. Vac., Lb./Hr.[3]
6	1,120	828
8	2,060	1,530
10	3,340	2,550
12	5,200	3,860
14	7,730	5,760
16	9,900	7,370
18	12,900	9,600
20	16,300	12,200
24	24,500	18,300
30	40,000	30,000

1. Capacity in lb./hr. of steam at pressure drop noted through 20 ft. of straight pipe with 2 ells and 1 square-edge entry.
2. At 26-in. vac. with 5% pressure drop.
3. At 27-in. vac with 2% pressure drop.

Cooling Water Inlet Pipe Sizes for Various Flow Rates[1]—Table II

Pipe Size, I.P.S., Inches	Water Rate, Gpm.	Flow Velocity, Fps.	Vel. Head, $V^2/2g$	Friction Loss, per 100 Ft. Pipe, Ft. of Water
2	50	5.10	0.40	10.0
2½	80	5.30	0.43	8.0
3	120	5.50	0.46	7.0
4	200	5.10	0.41	4.5
5	320	5.25	0.42	3.5
6	450	5.12	0.41	2.8
8	835	5.40	0.43	2.1
10	1,250	5.10	0.41	1.5
12	1,800	5.10	0.41	1.3

1. From "Cameron Hydraulic Data," with some figures rounded off. Based on practical water-flow velocity of 5-6 fps. in pipe. Approach to condenser distributor should be much less to insure smooth flow over weir.

length/diameter ratio of 2.0 is sufficient in large condensers. This should be increased to perhaps 3.0 to give adequate length for fall of water in smaller condensers.

According to these rules, for our design, we should select a shell diameter of about 36 in. (actually 32 in.), and a shell length of 2D = 72 in.

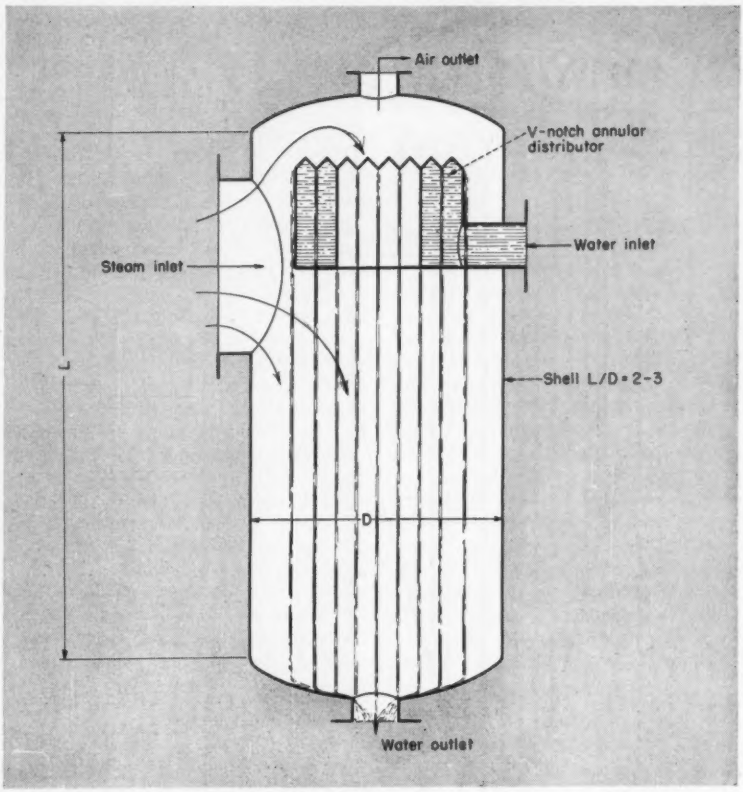
6. From the pressure conditions of operation, and an estimate of corrosion, calculate the shell thickness. This thickness should be calculated for 15 psig. external pressure, by means of one of the various formulas for vessels under external pressure. For example, use Fig. USC-28 in the 1952 ASME Unfired Pressure Vessel Code; or more easily, use the chart based on the ASME Code in Major's article (*Chem. Eng.*, Apr. 1955, p. 175). Using this chart, the necessary plate thickness works out at $\frac{3}{16}$ in. How much extra to allow for corrosion will depend on circumstances.

Contaminants in either the cooling water or the vapor may cause corrosion troubles. Fresh water usually requires little addition to the shell thickness, but salt water, and especially under conditions of high temperature and stagnant pockets, may result in severe corrosion. This is generally localized, but can lead to considerable trouble if not found and corrected. Both fresh and salt water may cause serious damage at the water level, due to air oxidation at the point of water-air contact.

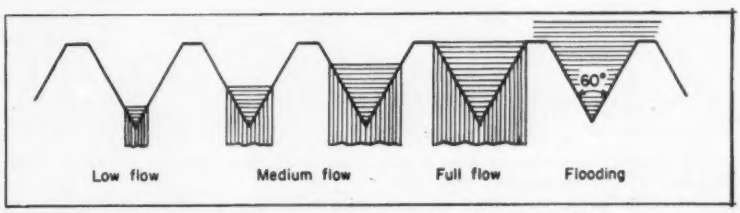
7. From the tail pipe size, calculate a suitable hot well size. Later on we shall examine a number of designs. For the present it is enough to note that the hot well must have sufficient capacity to fill the tail pipe without breaking the liquid seal. We have chosen an 8-in. tail pipe, having a capacity of about 90 gal. in 34 ft. of length. Therefore, the capacity of the hot well above the top of the discharge tee must be more than 90 gal.

An Improved Design

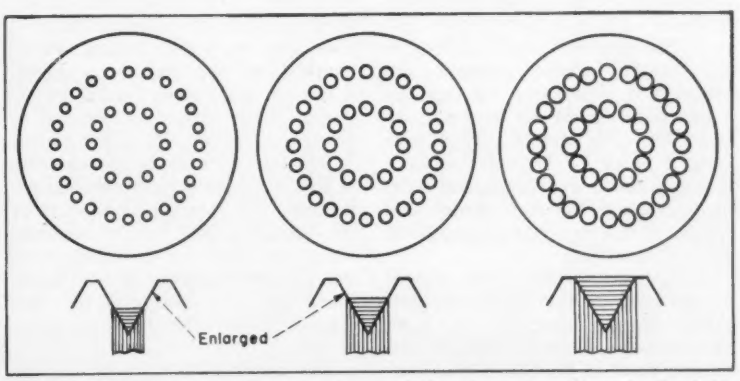
From the foregoing we have learned some of the characteristics of a barometric condenser and we have designed one completely except for the water distribution system. In deciding how we should combine the best features of earlier designs and capitalize on experience in con-



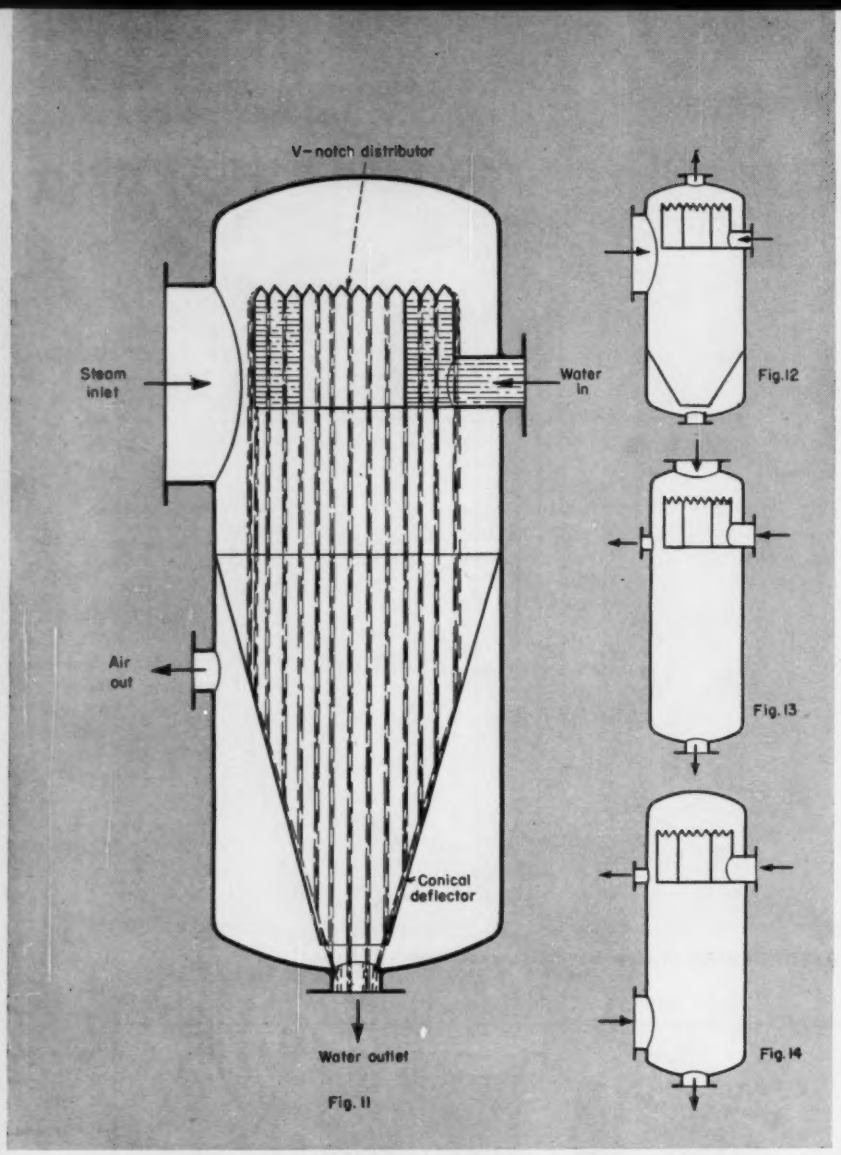
BASIC DESIGN of How barometric condenser—(Fig. 8)



V-NOTCHES flow larger streams at greater depths—(Fig. 9)



SMALL CIRCLES on plan view show relative flow at various depths indicates by V-notches—(Fig. 10)



PREFERRED variation of Fig. 8 is a semi-entraining condenser with conical deflector at the discharge—(Fig. 11)
SOME POSSIBLE variations of basic design of Fig. 8—(Figs. 12-14)

denser operation, it is worthwhile reviewing the principal characteristics of a successful condenser.

1. The approach, that is, the temperature difference between the steam and the water leaving the condenser, should be as small as possible. The normal limits are from 5 to 10 F. We have already assumed good operation and adequate contact between steam and water, and based our calculations on a 5° approach.

2. The non-condensables should be removed as thoroughly as possible, since otherwise a high vacuum (and a correspondingly low boiling point in the last effect) cannot be attained.

3. The pressure drop of the steam as it passes through the unit must be as low as possible, since otherwise the highest vacuum attainable with the available cooling water temperature will not be achieved. A low pressure drop cannot be attained if the steam is required to rupture a curtain of falling water.

The design shown in a basic form in Fig. 8 achieves these various objectives. An interesting feature of the design is that the fundamental idea need not be modified, even though the location of the steam inlet and the water outlet are changed to suit the designer's preference.

The essential feature of this design is a simple annular water distributor designed to give a high degree of flexibility without high pressure drop. The distributor consists of a doughnut-shaped channel with serrations in the weirs at the top of both the inner and outer peripheries. The V-notch serrations have a bottom angle preferably in the range from 60 to 90 deg. Depending on the height of water in the distributor, each serration will flow a larger or a smaller stream.

Fig. 9 shows how these streams will merge to form continuous curtains only at overload flow rates when the crest height is above the top of the narrow lands between notches. In Fig. 9 the first four notches suggest the character of the water streams at four possible flow rates within the normal capacity of the condenser. The fifth notch, at the right, indicates that the condenser can still function for serious overloads, but with some sacrifice of pressure drop due to the formation of a continuous curtain.

At less than overload rates, pressure drop is minimized, since the separate streams do not tend to merge and thus allow steam contact on all sides without the need for disrupting a curtain of water. To make this feature still more evident, Fig. 10 gives an approximate idea of the size of the streams, in plan view, at three flow rates from low to high capacity.

Flow Over Weirs

Calculation of the size and number of notches required to give a desired range of flow rates from the distributor requires a certain amount of cut and try. The usual V-notch weir flow formula was developed for flow in larger streams, but under conditions of laboratory accuracy it has been found by various investigators to give good reproducibility and precision even in smaller sizes. For want of a better formula, the following will give better than a first approximation:

$$\text{gpm.} = 1{,}122\ (\tan \theta/2)^{0.496} h^{2.47}$$

where θ is the notch angle and h is the height of the crest in inches above the notched bottom. This is a slightly corrected version of the usual empirical formula, cu.ft./sec. $= 0.58 \times (8/15) \times \tan (\theta/2) h^2 \sqrt{2gh}$, and is claimed to give a good degree of accuracy if the weir edge is sharp and the velocity of approach is negligible.

(The modified formula has been presented as a nomograph by

Lowenstein, *Chem. Eng.*, Oct. 1954, p. 274.—*Editor.*

The purpose of the V-notches in the water distributor is not, of course, to meter the flow, but rather to divide it into a number of streams, and so give a condenser of minimum pressure drop. The object in choosing the notch angle and depth is to permit the full design flow rate without using the entire notch depth, thus leaving some freeboard for over-design flow rates.

Experience has shown a small 60 deg. V-notch most suitable. With a width at the top of no more than 1 in. and with ½-in. lands between notches, the circular weir delivers the desired number of small streams of water.

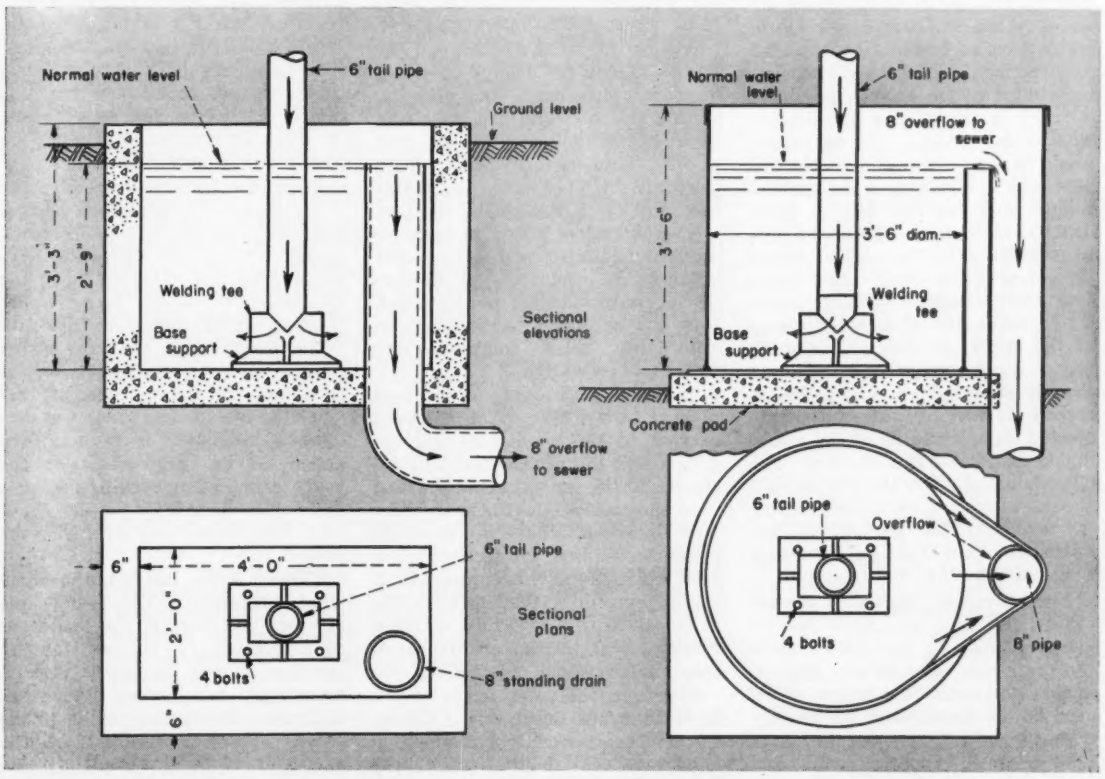
Variations of Basic Design

In the design of Fig. 8 the air outlet is at the top, which gives counterflow so far as the air is concerned. However, we have noted that it does not make much difference in condenser performance if even the air flow is parallel. This leads to the design of Fig. 11 which can be termed a semi-entraining version of Fig. 8. The use of an outlet cone to converge the water streams toward the outlet causes part of the air to collect under the cone for removal, while part of it is trapped by the discharge water and carried out the tail pipe. In any condenser where all or a part of the non-condensables are entrained by the falling jets, the tail-pipe velocity must be high enough to prevent backward escape of the trapped air. This velocity is generally from 5 to 8 ft. per sec., depending on the diameter of the tail pipe leading to hot well.

Fig. 11 is the preferred variation of this condenser. Figs. 12, 13 and 14 are included to show other variations which are possible. The first of these has an outlet cone, but the non-condensables are removed from the top. In the second, the steam inlet is at the top, and the air outlet at the side. The last shows conventional countercurrent flow, with the steam inlet near the bottom and the air outlet near the top. In all these the water distributor is of the same type as in Figs. 8 and 11. They are not preferred designs, but do show the flexibility of this method of water distribution from a V-notch distributor.

Hot Well Design

We have already seen that the hot well serves three purposes: (1) provides a means for discharging the heated condenser water; (2) seals the bottom of the tail pipe; and (3) provides a permanent storage basin containing enough water to fill the tail pipe to barometric height on start-up, without breaking the seal. Many types have been used. The designs indicated in Fig. 15 (concrete) and Fig. 16 (steel) fulfill the three objectives, but have the advantage of being somewhat smaller and less expensive than those generally employed. It will be noted in both designs that the entire weight of the condenser and



HOT WELL design of concrete for condenser with 6-in. tail pipe—(Fig. 15)

HOT WELL design of welded steel for condenser with 6-in. tail pipe—(Fig. 16)

tail pipe is carried on a fabricated steel foot welded to the outlet tee.

Conventionally, hot wells are built mostly below ground, of concrete construction and usually of more than ample proportions. The equipment supplier rarely has an interest in a concrete hot well except to make sure that the user constructs it large enough. The concrete design in Fig. 15 is shown for installation below ground. The steel design of Fig. 16 (which might well be fabricated by the condenser manufacturer) is installed above ground except for the concrete pad. Both types were designed conservatively to have sufficient capacity for a 6-in. tail pipe but would, in fact, be large enough for the 8-in. tail pipe in our design problem. In both types the overflow to the sewer is shown one pipe size larger than the tail pipe to afford proper drainage.

Installation and Operation

Fig. 1 indicates the general arrangement of a barometric condenser installation, showing the condenser body, the tail pipe, the hot well and the overflow of cooling water to the drain or sewer. Generally such an installation is placed outside the building wall housing the equipment to be evacuated. It is rarely enclosed, even in climates with cold winters. The condenser needs no other support than the tail pipe which furnishes a substantial column and requires only a strut brace about half way down the pipe to control deflection. The vapor pipe from the equipment being evacuated always has enough rigidity to take care of any deflections of the upper structure. If the air pump is of the mechanical type (rarely used today), it will be installed inside. If of the steam ejector type, it can be placed either inside or outside the building. For outside installation the connections should, of course, be well insulated. All condensation should be permitted to drain free and downward to avoid freezing.

For convenient access by the operator, all services with control valves should be run from inside the building. Condenser maintenance is seldom a problem, so access need not be provided to the body.

For most efficient regulation of cooling water supply to the condenser, it is best to relieve the operator of the burden of controlling the flow rate manually. This is especially true where the performance guarantee specifies a 5° differential (approach). The automatic control valve will be actuated from the differential.

We noted earlier that a barometric condenser should customarily be somewhat over-designed to take care of unforeseeable performance on the part of the equipment with which it is associated. This is worth considering in a little further detail. There are three main factors affecting the operation of a given condenser, including: (1) the quantity and temperature of vapor coming over to it from earlier equipment (e.g., last effect of an evaporator); (2) quantity and temperature of water supplied to the condenser; (3) the capacity of the pump for the non-condensables.

Suppose, for example, that the condenser is the last link in a chain consisting of a double-effect evaporator. In evaporator installations the steam to the first effect is quite commonly exhaust steam from some other operation. Its temperature and pressure are, therefore, likely to be dependent on operations elsewhere in the plant and beyond the control of the evaporator operator. Suppose temperature and pressure of this steam should fall, resulting in less heat delivery to the first effect. This reduces first effect evaporation and hence decreases heat supply to the steam chest of the second effect. This in turn reduces the quantity of heat in vapor going to the condenser. If the condenser water flow is not changed, then the approach temperature or differential must increase, and water will be wasted.

Conversely, assuming an increase in heat to the first effect, the heat carried to the condenser will increase and the differential will decrease. At the same time, in the first case the vacuum in the last effect will increase, that is, absolute pressure will fall, and in the second case, the vacuum will decrease. Both these happenings tend to alter the evaporation rate toward a common level, so that the system will have some inherent self-regulation.

However, this also points to the desirability of automatic differential temperature control of a flexible condenser of size more than adequate for normal operation. By varying the water flow rate to maintain the differential, the vapor temperature can be allowed to fluctuate sufficiently to maintain a substantially constant evaporation rate, regardless of moderate variations in heat supply to the first effect.

This, of course, presupposes the ability of the non-condensables pump to remove the air as fast as it accumulates in the condenser. Since external air leaks are the source of most non-condensables, entire system should be checked for in-leakage while it is under vacuum and all leaks stopped with a sealing compound such as shellac. If at the operating temperature the equipment is above the melting point of shellac, a synthetic resin such as a glyptal lacquer can be used effectively. In any event, coating every suspicious place with something which is both liquid and viscous will stop the trouble.

A number of times we have mentioned a vapor inlet pressure of 27 in. Hg as suitable for most barometric condenser work. This is because with the ordinary setup of multiple-effect evaporators, a vacuum of 27 in. Hg (saturation temperature 115 F.) is high enough. While it is true that a lower pressure would result in more evaporation, a temperature lower than this in the last effect generally results in sluggish circulation due to increase in viscosity of the liquid.

Since most barometric condensers are used on multiple-effect evaporator installations, it is worthwhile noting the proper procedure in starting up and shutting down the condenser to avoid large losses through entrainment during shut down. To start up: (1) turn on the cooling water to the condenser, at least half the normal amount; (2) start the ejector and raise the vacuum to the highest point; (3) turn steam on the first effect of the evaporator at full working pressure after all evaporator bodies have been filled to working level with the liquor.

Closing down, the order is somewhat different: (1) stop the ejector; (2) turn off the condenser cooling water; (3) shut off steam to the first effect; (4) open vacuum breaks on each effect. Large entrainment losses can result if the steam valve is closed first, since the vacuum will build up quickly and produce boiling-over in the last effect.

Shortcuts for Transient Heat Flow

Your quickest solution to a problem in unsteady-state heat conduction may be to take the long way around via an analytical or graphical method. Here are the methods available today

IRVING GRANET and ROBERT M. GOULD, Foster Wheeler Corp.†

ONLY recently have chemical engineers concerned themselves with the problems of unsteady-state heat conduction. Yes, there have always been some curing and drying operations that required a knowledge of how temperature varied with time or with position within a mass that was being heated.

However, for a large percentage of heat transfer equipment we didn't worry about unsteady-state heat flow. Usually, we assumed steady-state conditions for our calculations.

And we almost always got away with it. We didn't push processes up to the limit of the materials used for construction. In those rare instances where failure did occur, it was because "we pushed the process too far." And this was an acceptable excuse.

Today's technology calls for some different thinking on this subject. We are dealing—in more and more cases—with very expensive metals under extreme reaction conditions. Because of competitive process economics, we're building equipment for use where the process conditions approach the operating temperature limits of the materials of construction. It's important for us to know where and how much we can push.

Here's one simple example. Consider a lead shield in a nuclear reactor. The shield might be designed to pass a certain amount of heat at an allowable average temperature. However, if at any time the temperature at any point exceeds the melting point of lead, we will have a failure.

Therefore, the design engineer who plans this nuclear reactor must have a rather accurate knowledge of the transient temperature conditions at every point in the shield before he begins his calculations.

This is just one of many practical engineering applications that we could cite. Now, how do we find these transient temperature values?

TRANSIENT CONDUCTION

The calculation of any problem in transient conduction consists essentially of being able to solve, with the proper boundary conditions, the following general equation in cartesian coordinates:

$$\frac{1}{\rho C_p}\left[\frac{\partial}{\partial x}\left(k_x\frac{\partial t}{\partial x}\right)+\frac{\partial}{\partial y}\left(k_y\frac{\partial t}{\partial y}\right)+\frac{\partial}{\partial z}\left(k_z\frac{\partial t}{\partial z}\right)\right]=\frac{\partial t}{\partial \theta} \quad (1)$$

If we assume that the material is isotropic and homogeneous, and if we neglect variations of k with temperature (or use the proper average value), Eq. (1) becomes

$$\frac{k}{\rho C_p}\left[\frac{\partial}{\partial x}\left(\frac{\partial t}{\partial x}\right)+\frac{\partial}{\partial y}\left(\frac{\partial t}{\partial y}\right)+\frac{\partial}{\partial z}\left(\frac{\partial t}{\partial z}\right)\right]=\frac{\partial t}{\partial \theta} \quad (2)$$

By definition, the term $k/\rho C_p$ is known as the thermal diffusivity of the material and is given the symbol α.

Many cases of practical interest can be treated as one-dimensional transient heat conduction problems and Eq. (2) may be reduced to the simpler form:

$$\alpha(\partial^2 t/\partial x^2)=\partial t/\partial \theta \quad (3)$$

We can find solutions of Eq. (3) for various shapes in the literature of physics, mathematics and heat transfer. McAdams[1] gives a general resume of these solutions and sources.

However, the solutions available cover only a very limited number of conditions and very often a problem of practical interest cannot be

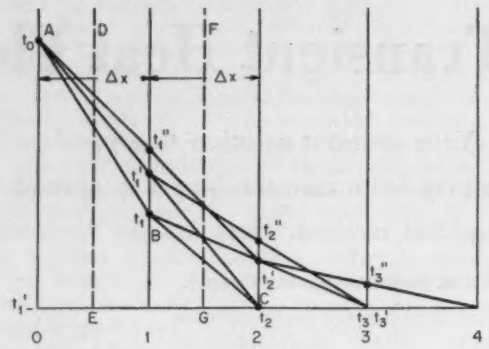
† Mr. Gould is presently with the Goodman Electric Machinery Co., Newark, N. J.

Nomenclature

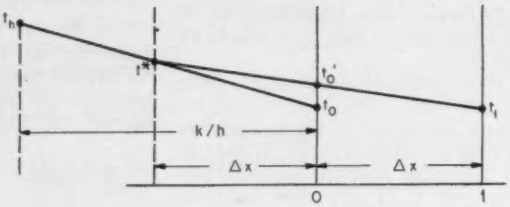
C_p	Specific heat at constant pressure, Btu./lb.-°F.	t	Temperature of a point at a given time, °F.	t^*	Outside temperature of fictitious layer, °F.
d	Derivative of	t_h	Surrounding fluid temperature, °F.	x	Normal distance from surface to point, ft.
h	Coefficient of heat transfer between surroundings and surface, Btu./hr.-ft.-°F.	t_i	Initial temperature of body, used interchangeably with t_b, °F.	x	Thickness of slab, ft.
k	Thermal conductivity, Btu./hr.-ft.-°F.	t_m	Mid-plane temperature, °F.	x, y, z	Cartesian coordinate axes
M	Modulus, $(\Delta x)^2/\alpha\,\Delta\,\theta$	t_0, t_1	Temperature at section 0, 1, etc., °F.	∂	Partial derivative of
N	Number of sections body is divided into	t'	Intermediate calculation temperature for section indicated by subscript, °F.	α	$k/\rho C_p$, sq. ft./hr.
S	Area through which heat flows at right angles, sq. ft.			Δ	Increment of
				θ	Time from the start of a process, hr.
				ρ	Density of solid material, lb./cu. ft.

Analyzing Unsteady-State Conduction

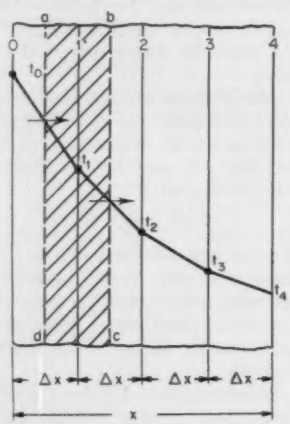
The problem (Fig. 1)



Schmidt solution (Fig. 2)



Closer approximations (Fig. 3)



M	t_1'
2	$[t_0 + t_2]/2$
3	$[t_0 + t_1 + t_2]/3$
4	$[t_0 + 2t_1 + t_2]/4$

Heat balance on zone abcd

$$\frac{KS(t_0 - t_1)}{\Delta x} - \frac{KS(t_1 - t_2)}{\Delta x} = \frac{S(\Delta x)\rho Cp(t_1' - t_1)}{\Delta\theta}$$

$$\frac{K}{\rho Cp} = \alpha; \quad \frac{(\Delta x)^2}{\alpha\Delta\theta} = M$$

$$t_1' = \frac{t_0 + (M-2)t_1 + t_2}{M}$$

(Fig. 4)

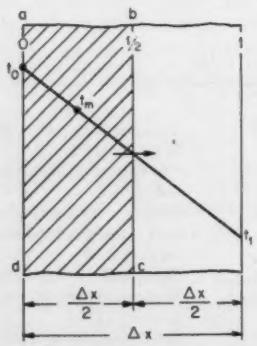
Heat balance on zone abcd

$$hS(t_h - t_0) - \frac{KS(t_0 - t_1)}{\Delta x} = \frac{S(\Delta x)\rho Cp(t_m' - t_m)}{2\Delta\theta}$$

$$\frac{K}{\rho Cp} = \alpha; \quad \frac{(\Delta x)^2}{\alpha\Delta\theta} = M; \quad \frac{h\Delta x}{K} = N; \quad t_m' - t_m = t_0' - t_0$$

$$t_0' = \frac{2Nt_h + [M-(2N+2)]t_0 + 2t_1}{M}$$

To make $M-(2N+2)$ positive; $M > 2N-2$



solved by use of these published solutions. In such cases, it is necessary either to solve Eq. (3) by using calculus or else to resort to one of the numerical or graphical methods that have been developed.

AVAILABLE METHODS

The pioneer graphical method for the approximate solution of transient heat conduction problems was developed by E. Schmidt in 1924.[2] His method is based on the substitution of a finite increment for the differential and the assumption of physical properties that are independent of temperature. We can develop the Schmidt method as follows:

Consider a slab of uniform thickness, x, initially at a uniform temperature t_i. At time $\theta = 0$, the surface of the slab is raised to and maintained at temperature t_0. Fig. 1 is a plot of temperature vs. thickness for this slab.

Divide the slab into a number of sections, N, of equal thickness $\Delta x = x/N$. After some time, θ, the temperatures at planes 0, 1 and 2 will be t_0, t_1 and t_2 (points *A*, *B* and *C*).

Bisect the first section by imaginary plane *DE*, and the second section by plane *FG*. As an approximation, the temperature gradient at *DE* is equal to

$$-dt/dx = (t_0 - t_1)/\Delta x \qquad (3a)$$

and at *FG*,

$$-dt/dx = (t_1 - t_2)/\Delta x \qquad (3b)$$

At this time, the rate of conduction into *DE* exceeds that out at *FG* by the difference

$$[kS(t_0 - t_1)/\Delta x] - [kS(t_1 - t_2)/\Delta x]$$

During the time increment $\Delta\theta$, the excess heat will raise the average temperature of the solid, *DEFG*, from t_1 to t_1'.

The heat balance is

$$[kS(t_0 - t_1)/\Delta x] - [k_S(t_1 - t_2)/\Delta x] = S(\Delta x)\rho C_p(t_1' - t_1)/\Delta\theta \qquad (4)$$

Since $k/\rho C_p$ is equal to α, Eq. (4) reduces to

$$[(t_0 + t_2)/2] - t_1 = (\Delta x)^2(t_1' - t_1)/2\alpha\,\Delta\theta \qquad (5)$$

Now if $\Delta\theta$ is chosen so that $(\Delta x)^2/\alpha\Delta\theta$, denoted by the term M, is numerically equal to 2.0, then Eq. (5) becomes

$$t_1' = (t_0 + t_2)/2 \qquad (6)$$

The same relationship holds for other sections of the slab and for other time intervals.

If the surrounding temperature

rises, rather than the surface temperature, and if the surface coefficient is h, the heat transferred to the surface is given by the relationship

$$hS(t_h - t_0) = -kS(dt/dx) \qquad (7)$$

where t_h is the temperature of the fluid; and t_0 is the surface temperature.

To apply the Schmidt method, assume a fictitious layer of the same material, Δx thick, preceding the surface. The temperature of the outer layer of this surface is t^*. If we refer now to Fig. 2, we get the expression

$$-(dt/dx)_0 = (t^* - t_0)/\Delta x$$

And combining this relationship with Eq. (7) gives

$$\frac{t^* - t_0}{t_h - t_0} = \frac{\Delta x}{k/h} \qquad (8)$$

By similar triangles, we can see that if t_h is plotted at distance k/h from 0 and a line is drawn from t_h to t_0 at a distance Δx, we will have t^*. This is then used with t_1 to get t_0', using the equation

$$t_0' = (t^* + t_1)/2$$

OTHER APPROXIMATIONS

Schmidt's rule is a very useful approximation. However, as shown on Figs. 3 and 4, closer approximations can be obtained if we allow M to take on values that are greater than 2.

Fig. 3 shows a development that is similar to that of Dusinberre.[4] Note that when $M = 2$ the results would be the same as those that would be obtained above. However, if at any time t_2 were greater than t_1 and t_0, t_2 should have an effect on t_2'. An M of 3, or 4, takes this into account. The same holds true for the boundary condition shown on Fig. 4.

C. M. Fowler[5] has reviewed convergence rules for solutions of transient conduction and arrived at this relationship:

$$M - 2 \gtrless (N^2 + 1)^{0.5} - 1 \qquad (9)$$

A choice of M and N that fits Eq. (9) will give a proper solution to the problem.

Several researchers have plotted the theoretical temperature-time relations in terms of four dimensionless ratios. These are very amply covered in McAdams[1] and we'll not repeat them here. Of particular interest are the charts that give the mid-plane and surface temperatures of large slabs and charts for semi-infinite solids.

Calculated Solutions to Transient Conduction Problem

$\Delta\theta$	t_h	t_0	t_1	t_2	t_3	t_4	t_5
b) Crude Schmidt Method							
0	100	0	0	0	0	0	100
1	100	50	0	0	0	50	100
2	100	50	25	0	25	50	100
3	100	62.5	25	25	25	62.5	100
4	100	62.5	53.75	25	43.75	62.5	100
5	100	71.9	43.75	43.75	43.75	71.9	100
6	100	71.9	57.8	43.75	57.8	71.9	100
c) Improved Schmidt Method, M = 2							
0	100	0	0	0	0	0	100
1	100	(48)	(15)	0	(15)	(48)	100
2	100	57.5	24	15	24	57.5	100
3	100	62	36.25	24	36.25	62	100
4	100	68.1	43	36.25	43	68.1	100
5	100	71.5	52.15	43	52.15	71.5	100
6	100	76.1	57.25	52.14	57.25	76.1	100
d) Improved Schmidt Method, M = 3							
0	100	0	0	0	0	0	100
1	100	(45)	(10)	0	(10)	(45)	100
2	100	58.4	18.3	6.7	18.3	58.4	100
3	100	59.5	27.8	14.4	27.8	59.5	100
4	100	65.5	33.9	23.3	33.9	65.5	100
5	100	67.5	40.9	30.4	40.9	67.5	100
6	100	71.5	46.2	37.4	46.2	71.5	100
7	100	73.6	51.7	43.3	51.7	73.6	100
8	100	76.5	56.7	48.9	56.7	76.5	100
9	100	78.5	60.5	53.7	60.5	78.5	100
e) Improved Schmidt Method, M = 3, 1/2-in. Slices							
0	100	0	0	0	0	0	
1	100	(33)	(9)	(1)	0	0	
2	100	39.3	14.4	3.3	0.3	0	
3	100	42.9	19.0	6.0	1.2	0.2	
4	100	46.0	22.6	8.7	2.5	0.87	
5	100	48.4	25.8	11.3	4.03	1.96	
36	100	77.50	67.0	58.95	53.80	52.15	

Note—Values in parentheses taken from charts in McAdams.

HOW TO SOLVE PROBLEMS

To illustrate the use of the numerical methods outlined above, we'll take one problem in unsteady-state heat conduction and solve it five ways. Consider this problem:

Dry wood slabs, 4-in. thick, initially at a uniform temperature of 0 F. are suddenly exposed to warm dry air maintained at 100 F. The wood has a thermal conductivity of 0.12 Btu./hr.-ft.-°F.; a density of 51.5 lb./cu. ft.; and a specific heat of 0.20 Btu./lb.-°F. The surface coefficient on each side is constant at 1.44 Btu./hr.-sq. ft.-°F. Edge and end effect may be neglected. Predict the temperature at the surface, and at the midplane, 1.788 hr. from the start.

We'll solve the problem using these five methods:

a) Charts given in McAdams.

b) Schmidt method using 1-in. slices.

c) Modified Schmidt method, considering the slab to behave like a semi-infinite solid for the first time increment and using 1-in. thick slices for our analysis.

d) Schmidt method using $M = 3$.

e) Modified Schmidt method, as described above, but with ½-in. slices.

After we have worked out our solutions, we'll compare our choice of M values with the Fowler rule given in Eq. (9).

In the table on p. 186 we have summarized how our solutions *b*, *d* and *e* fit the Fowler rule.

CHART SOLUTION

Using the proper chart and following the procedure outlined by McAdams (p. 35 *et seq.*), the surface temperature, t_0, is found to be 77 F. The mid-plane temperature, t_m, is 50.5 F.

SCHMIDT METHOD SOLUTION

If we divide the slab into four 1-in. slices and consider it to be

Fitting the Fowler Rule to the Solutions

Solution	M	N	$(N^2+1)^{0.5}-1$	M − 2	Meets Rule?
b	2	1	0.414	0	No
d	3	1	0.414	1	Yes
e	3	0.5	0.12	1	Yes

Solution	Initial Temperature	M	N	Does t_o Increase Reasonably?	t_o	t_m
a	———	—	—	———	77.0	50.5
b	Poor	2	1	No	71.9	43.8
c	Good	2	1	No	76.1	52.2
d	Good	3	1	No	78.5	53.7
e	Good	3	0.5	Yes	77.5	52.2

symmetrical about the mid-plane.

$$\alpha = k/\rho C_p = 0.12/51.5(0.2)$$
$$\alpha = 0.01165$$
$$\Delta\theta = (\Delta x)^2/2\alpha$$
$$= (0.0833)^2/2(0.01165)$$
$$\Delta\theta = 0.298 \text{ hr.}$$
$$\text{Number of } \Delta\theta\text{'s required} = 1.788/0.298 = 6.0$$

Now we can apply the Schmidt rule:

$$t_1' = (t_0 + t_2)/2;$$
$$t_2' = (t_1 + t_3)/2; \text{ etc.}$$

For the boundary conditions, k/h equals 0.12/1.44 or 0.0833, which is equal to Δx. Therefore, the Schmidt rule gives us $t_o = 71.9$ F. and $t_m = 43.75$ F. (See table for calculated values.)

IMPROVED SCHMIDT SOLUTION

For our third solution we'll take the value of M as being equal to 2.0. Using the chart in McAdams for semi-infinite solids, we find that $t_o' = 48$ F. The temperature between slices 1 and 2 at the end of the first time increment—again from a chart—is $t_1 = 15$ F.

Other values can be worked out using the Schmidt method and are tabulated above. We find that $t_o = 76.1$ F. and $t_m = 52.15$ F.

In our fourth solution we'll take the value of M as 3.0. Then,

$$\Delta\theta = (0.0833)^2/3(0.01165)$$
$$\Delta\theta = 0.1987 \text{ hr.}$$
$$\text{Number of } \Delta\theta\text{'s} = 1.788/0.199 = 9.0$$
$$N = h\,\Delta x/k$$
$$N = (1.44)(0.0833)/0.12 = 1.0$$

In this case, since M is equal to less than the quantity $(2N + 2)$, t_o will have a negative effect on the calculation of t_o'. We have worked out the temperature values in the table on p. 185.

We can see that t_o rises in an irregular manner because of the negative effect of t_o in the equation for the first slice.

For our fifth and final solution we'll use a value of 3 for M and use ½-in. slices. Then,

$$N = h\,\Delta x/k$$
$$= (1.44)(0.0416)/(0.12)$$
$$N = 0.5$$
$$\Delta\theta = (0.0416)^2/3(0.01165)$$
$$\Delta\theta = 0.0496 \text{ hr.}$$
$$\text{Number of } \Delta\theta\text{'s} = 1.788/0.0496 = 36$$

The table above summarizes the calculated temperature values. For this solution, $t_o = 77.50$ F. and $t_m = 52.15$ F.

FITTING FOWLER'S RULE

In the two summary charts above we have examined our selection of M values to see if they meet Fowler's rule for convergence. For the example that we have worked out, we find that all of the methods give fairly good approximations except the unmodified Schmidt method. However, even this solution might be adequate for most engineering purposes.

POWERFUL TOOLS

The methods that we have used in this article are very powerful tools and they have been extended to include two- and three-dimensional problems. Also, it is relatively simple to include such boundary conditions as radiation and convection at the surface; the internal generation of heat; and composite bodies.

For studies of these cases and others, we recommend the works of McAdams,[1] Dusinberre,[4] and Grinter.[5]

In this article we have limited ourselves to a discussion of the general problem of unsteady-state heat conduction in one dimension only. We wanted to present the methods of solution without the complications of two- and three-dimensional mathematics.

However, the mathematical problems can be minimized. Advances in the use of digital and analog computers point to more extensive use of these analytical methods.

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3. Fowler, C. M., *Quart. Appl. Math.*, Vol. 3, No. 4 (1946).
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CONTINUOUS WELDING of floor plates and caulking of intersections would have prevented this failure—Fig. 1.

Proper Design for Painting

Design can alleviate many of the personal application faults and material deficiencies that result in high costs for maintenance painting programs.

H. G. KIRTLEY and W. G. COLTER, Monsanto Chemical Co.

Service life of a protective system on most plant equipment and structures can be increased appreciably if proper consideration is given in the initial design.

Design for more economical painting maintenance does not necessarily imply that construction costs will be increased. In many cases the cost will be less or equal to existing methods. Frequently it will involve higher initial construction costs—but where this condition occurs maintenance expenditures must justify the additional expense on the basis of reduced painting maintenance in future years.

Design should continually strive to eliminate the need for maintenance painting. When this cannot be accomplished, there are certain fundamental considerations that will minimize maintenance painting.

Surfaces Must Be Accessible

Structures exposed to corrosive atmospheres should be so designed that all surfaces are accessible for proper surface preparation and painting. When this is not possible, painting specifications must be prepared in sufficient detail to insure painting in the erection phase when the components are accessible.

Plane Surfaces Best

A plane surface with a minimum of sharp projections or edges provides the optimum surface for economical application and maintenance of a protective coatings system.

Basic design and economics demand a high degree of irregularity in the physical shape of standard structural members, which makes them inherently difficult to protect and maintain. Since their use cannot be avoided in many applications, proper design can minimize the use of small sections. This approach may involve the substitution of large structural shapes for several

small ones or use framing methods that accomplish the same purpose.

Tubular sections should be used in place of standard structural shapes whenever practicable. Tubular shapes have several features not found in standard structural shapes. These are plane surfaces with a minimum of projections, less exposed surface area, and availability.

Economic Justification Required

Any design for the improvement of maintenance painting must have economic justification to merit the additional expenditure in the same manner as designs for manufacturing improvements. Accurate maintenance painting cost information must be available.

Due to the wide variety of exposure environments prevalent in most chemical plants, cost information must be accumulated on individual items of major equipment and individual manufacturing units. Annual maintenance painting cost on the same type of equipment within a plant will vary considerably depending upon the exposure, design, and materials of construction.

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Fabrication Details Important

Many maintenance painting problems are caused by inattention to design and fabricating details, which are numerous and varied in complexity but have the same general characteristic of accelerating paint failure when improperly designed. Some of the more common problems in this category are moisture, material entrapment, low spots and sealing of connections.

For example, a standard method of installing horizontal channel framing and particularly wall girts is with the flanges turned up—creating a shallow box where material and moisture can accumulate. These can be installed, just as easily, with the flanges down without affecting the structural strength or initial cost. Both painting maintenance and housekeeping are simplified.

Tack welded connections generally create a painting problem, and should be avoided whenever possible. Unsealed portions of such connections are usually cracks or crevices inaccessible for proper maintenance. They are areas where material and moisture can accumulate causing accelerated failure of paint on adjacent surfaces. Continuous welding of all connections should be rigidly adhered to insofar as practicable. When this cannot be done, caulking should be provided.

Fig. 1 is an example of steel floor plate tack welded to the supporting structure. Product spillage and moisture have destroyed the paint film on the top surface and adjacent areas of the supporting beams and floor plate. Regardless of the paint system applied to the underside of the floor plate and supporting structure, early failure of the paint at the point of intersection cannot be avoided.

One of the most practical methods of correcting the spillage problem is continuous welding of the floor plate sections to seal against the entrance of corrosive materials from above, and caulking of the intersecting joints to seal the inaccessible areas from below.

Another method of sealing floor plate connections is by use of gaskets, which involve bolting the floor plate to the supporting structure. This method is too expensive as a general standard, but is practical where removable floor plate sections must be installed.

Materials Influence Painting Costs

Painting requirements can be reduced and often eliminated if proper consideration is given to the materials of construction in the design stage.

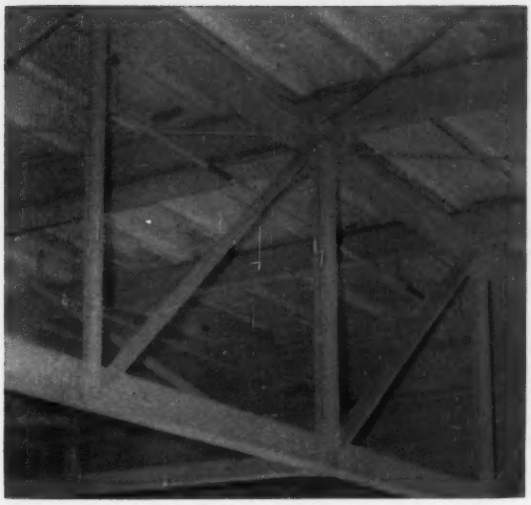
Carbon steel, the major material of construction, is one of the most expensive to protect in a corrosive environment. Substitution of other structural materials which offer better resistance to corrosion should be comparatively evaluated in all designs. When use of more expensive alloy materials cannot be justified, metal-coated steel is often a satisfactory compromise.

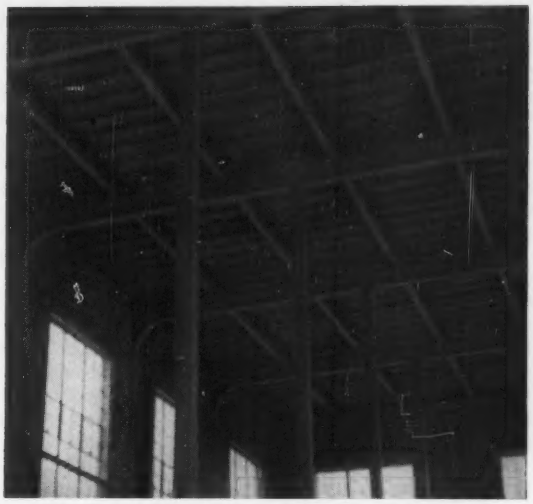
Zinc and aluminum are the most prominent metal coating materials because of their availability and cost, but a wide selection of metals can be used for this purpose. Zinc is applied by the hot dip or metallizing processes (metal spray), and aluminum by metallizing. Metal coatings have the added advantage of being reparable in the field and can be applied to existing structures.

Metal coatings are excellent corrosion inhibitors during the erection phase. Being physically stronger than standard coating materials, they withstand abrasion much better and generally require little in the way of field repairs. One difficulty encountered in the hot-dip galvanizing process with light structural shapes (8 in. and smaller) is warpage in sections over 10 ft. long. This may cause some delay during erection.

Lumber, pressure-treated with phenolic and asphalt derivatives, is an often overlooked structural material that generally requires a minimum of painting maintenance. In addition to resisting dry rot and termite attack, it offers some protection against selective chemical attack.

A number of plastic piping materials are available. However, a material in this category has not been developed with the broad range of physical properties found in steel or at a comparable price, which limits their use to special applications. Several plastic materials (in both corrugated and plain sheet form) are good replacements for the more conventional types of siding, corrugated roofing and window panels. Maintenance painting can be eliminated with most plastic materials.





STRUCTURAL FRAMING made up of numerous small sections (left) is inferior to large shapes (right)—Figs. 2, 3.

PROPER DESIGN FOR PAINTING

Equipment and Facilities

Structural Framing

Several methods are available to design for improving the painting maintenance of structural framing —particularly in corrosive environments where maintenance costs are high.

Primary consideration is to use designs having large structural shapes in place of built-up framing or numerous small sections. Pratt, Warren and Fink trusses use small structural shapes, generally angles, as intermediate members. Structurally this type of design is the most economical, but from the maintenance painting aspect it is the most expensive because the small sections are more difficult to paint and maintain.

Rigid or semi-rigid framing methods are preferred to conventional built-up truss systems, because they rely on large structural shapes which have a greater proportion of plane surfaces and fewer projections.

Fig. 2 illustrates a Deck Pratt truss in a manufacturing unit. Intermediate members are constructed of angles separated by spacers to form I-beams. Two problems are created: (1) the painting problem created by the small angle section, and (2) accessibility to the inner faces of the angles.

Fig. 3 is a contrast of Fig. 2. Semi-rigid framing is used in a building of the same type and size as that shown in Fig. 2. Deep I-beam trusses, with proportionately thicker flanges, simplify both initial painting and future maintenance. Cost of structural framing in each of the buildings is approximately the same.

Economical material substitutes, which will reduce or eliminate painting maintenance, are not generally available for steel in major structural framing. Best answer to date seems to be metal coating. Individual structural shapes can be metal-coated in the field or shop, but large built-up sections such as trusses must be field-coated due to the size limitation on commercial galvanizing vats.

Walls

Present trend in most industrial building construction, particularly in multi-story structures, is to eliminate brick masonry walls. This is because of their high cost, lack of flexibility, and maintenance of mortar joints in some chemical exposures.

Design of walls for industrial buildings should follow, where practicable, the same good paint design features as for other structures. These are a minimum of moisture pockets, angles, and sharp edges—with maximum accessibility.

Due to the variety of materials of construction, painting may or may not be necessary, or at the most necessary only for appearance. For example, a building designed for aluminum siding might be justified on the decrease in foundation cost. Allowing the aluminum to deteriorate and then replacing it might be cheaper than attempting to maintain it with paint.

This, of course, is contingent upon the life of unpainted aluminum as determined by severity of the exposure. Aluminum in a halide exposure will not give the performance that would be expected in an exposure where a protective continuous oxide film could be formed and retained.

Light-weight concrete block construction offers many advantages in that it is inexpensive and yet easily painted with many attractive colors. It requires a minimum amount of surface preparation and only needs to be free of dust, dirt and dry prior to painting. For warehouses, pumping stations, and similar buildings not containing flammable materials, one and two-story structures can be built without structural steel framing.

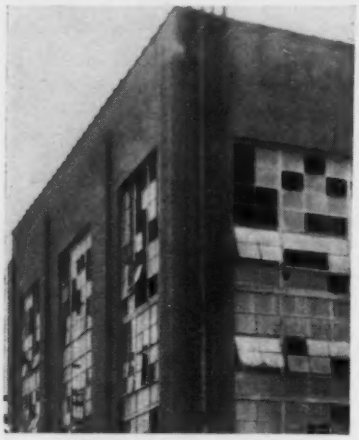
Corrugated asbestos-cement pro-

vides a relatively inexpensive siding if appearance is not important. Like concrete block, it is easily painted with a minimum of surface preparation. However, when not painted, it deteriorates fairly rapidly or darkens in exposures that will attack the cement binder. Stainless fasteners should be used to eliminate rust streaking and provide longer service life.

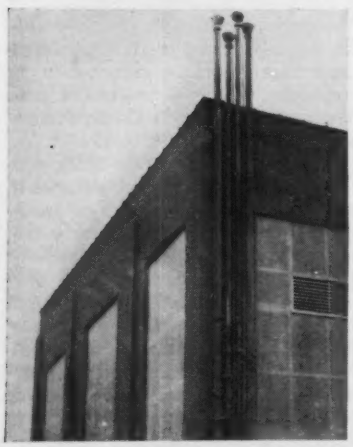
Galvanized corrugated sheet metal, compared with other sheet materials, is less suitable as a wall material since it requires a maximum paint system to maintain it properly in industrial exposures. Puncturing of the sheeting for fasteners immediately provides an opening for corrosive attack.

Plastic sheet panels, plain or corrugated, are relatively expensive materials at present. They are available in many colors, lightweight, and easily erected. They have good light transmission, varying from approximately 30 to 85%. This may be an advantage or disadvantage since darker shades pass colored light and have less light transmission. Panels are shatter resistant, and will provide explosion venting when properly erected. They do not ignite under 800 F., are readily washed free of most contaminates, and are attacked only mildly in severe exposures. But they do stain in some atmospheres.

Walls of heated structures with wood siding will require insulating materials to preserve exterior painting more than walls of any other siding material, since transmission of moisture vapor from the interior of the building will encourage wet-rotting of the siding and deterioration of the exterior paint film. If insulation is not provided, sufficient openings should be provided to permit circulation of air within the wall space.



Corroded steel sash—Fig. 4.



Plastic window panels—Fig. 5.

Windows

Severe fume exposures that exist in most chemical plants, plus the maintenance problems associated with conventional steel sash, make the design of windows one of the most attractive areas for reducing maintenance and painting costs.

Steel window sash often cannot be maintained properly in spite of frequent, expensive and thorough paint repairs. Glass replacement is high due to cracking of the panes by corrosive stresses developed in the sash. In one case, it was decided to allow the sash to deteriorate and plan for eventual replacement with improved window material rather than attempt to maintain the existing sash.

A galvanized bonderized sash was installed in the same building three years ago. No corrosion exists on this sash and the original paint has withstood the same exposure as the steel sash with a minimum of touch-up. Problem of glass breakage due to sash corrosion has been eliminated. It is important to paint the sash prior to glazing to provide maximum protection against corrosion in the sash area covered with glass.

Fig. 4 shows corroded steel sash with a large percentage of glass panes missing. Corrosion of the sash had developed stresses in the glass causing it to crack. Broken glass created such a hazard that it was necessary to remove it entirely.

To correct this situation, corrugated plastic window panels were installed as in Fig. 5. Essentially all painting and other window maintenance has been eliminated.

Bent Systems

One of the major maintenance painting functions is the protection of pipe supporting structures, commonly called pipe bents. Paint systems on these structures are frequently subjected to physical damage from yard and maintenance operations, in addition to attack from corrosive atmospheres.

Pipe bents are generally constructed of standard structural shapes such as those shown in Fig. 6. In this installation, columns and lateral braces are made of standard I-beam shapes that form the main supporting structure. Light angles are used for diagonal bracing. A multitude of edges and thin sections make the structure difficult to protect and maintain from the painting standpoint. Edge failure is well advanced on the smaller diagonal bracing.

Fig. 7 shows a pipe bent constructed of standard steel pipe and welded fittings. This design has used tubular shapes throughout—creating a structure of plane surfaces and one inherently more economical to paint and maintain.

Construction of pipe bents does not have to be limited to steel, as pressure-treated lumber can be used. If appearance painting can be disregarded, this represents a most economical material.

In new plant construction or where space limitations are not factors, elimination of conventional pipe bents should be considered. Their replacement with grade-level concrete bents would provide large initial savings in bent and pipe construction, and essentially eliminate painting maintenance. However, bridging of roadways would necessitate bent systems at those locations.

Wooden Structures

A definite field exists for treated structural lumber in the design of a number of miscellaneous plant structures. These are primarily tank farm walkways, loading platforms, ladders, pipe bents and fencing in areas of extreme corrosion.

Cost of pressure treatment varies

between 50 and 150% of the base cost of lumber. But the increased service life and reduced painting maintenance more than justify the additional expenditure for most wooden industrial structures.

Several phenolic base wood preservatives provide excellent surfaces for the application of paint. Those derived from bituminous compounds are not practical to paint due to bleeding of the preservative. It is important, if the chemical exposure is of major consequence, to select a preservative that is chemically suited for the environment. Failure to properly evaluate this problem can nullify the advantages gained by pressure treatment.

Piping

There are so many disadvantages connected with the use of plain steel pipe (with regard to maintenance painting), that a continual effort should be exerted by design to eliminate its use whenever possible. Many alloy and plastic substitutes are available. Although they are initially more expensive, they can often be justified by reduced maintenance.

Painting maintenance of steel pipe can be immeasurably improved and often eliminated by the use of galvanized pipe in applications where plain steel is a satisfactory material of construction. However, there may be some process applications where zinc will contaminate the material to be handled, in which case it cannot be used.

Many years of service in areas of severe chemical exposure have demonstrated the superiority of galvanizing over steel. Galvanized pipe in itself is not a cure-all, but zinc being a sacrificial metal with a relatively inert corrosion product provides an excellent surface for painting.

Most attractive feature of galvanized pipe is its cost, which is about 25% above that of plain steel. The cost difference is generally less than the cost of cleaning steel pipe, which is a definite advantage in itself. Cleaning of galvanized pipe generally requires no more than wiping with a solvent rag to remove oils, dirt and other foreign accumulations. Primes are available for galvanized surfaces that require no prior surface treatment for adherence.

Painting can be better coordinated with the use of galvanized pipe. It does not have to immediately follow erection to insure the most satisfactory and economical job, as is the case with plain steel pipe.

Main objection to galvanized pipe is the fume problem where welding fabrication is involved, as the fumes are both toxic and obnoxious. This problem can be overcome in the welding shop with adequate fume removal and respiratory equipment. This equipment is inexpensive, readily available, and should be provided for all welding shops that fabricate galvanized material.

Methods for removing the zinc prior to welding are practical and involve a very nominal expenditure. A muriatic acid dip using 30 to 34% acid will remove the zinc in a minute or less. Portable grinders or special cutting attachments for pipe threading machines can be employed. Weldments on galvanized pipe can be metallized or protected with zinc base coatings to restore the zinc to the exterior surface.

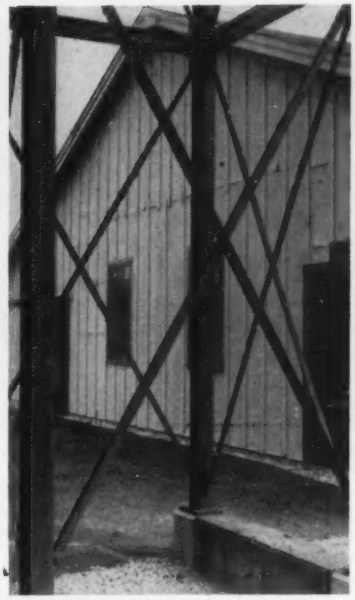
Tanks

In general, cylindrical and spherical tanks provide excellent surfaces for economical maintenance of paint systems. Aside from the selection and application of protective coating systems, most maintenance painting problems involve the appurtenances (supports, platforms, ladders), erection methods, and materials of construction.

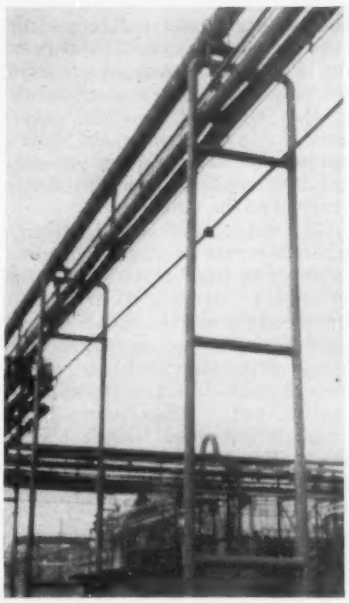
Light-gage alloy tanks (instead of lead-lined steel, clad, or steel tanks lined with other special coatings) provide design with a means of overcoming both process and exterior corrosion in one operation. Light-gage alloy tanks are limited to where the operating pressure is in the atmospheric range. Primary justification for up-grading the material of construction is usually process corrosion. Maintenance painting is in most instances eliminated.

Steel tank supports can be a source of excessive painting maintenance when constructed of standard structural shapes. Tubular supports should be standard for design purposes as they provide the best painting surface.

Fig. 8 is an example of a tubular support for a light gage Monel tank. Half the pipe section has been extended almost the length of the straight side of the tank to provide additional rigidity. Precautions must be taken to prevent accumulation of moisture on the interior surfaces. In this particular installation, base plates were drilled and welded to the legs. A small triangular section was cut from the base of each leg large enough to accommodate a rachet wrench. After the tank was set on the foundation

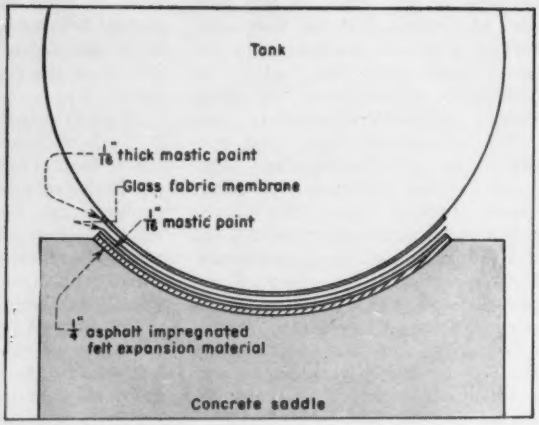


Conventional pipe bents—Fig. 6.



Tubular pipe bents—Fig. 7.

TUBULAR tank supports provide best surface—Fig. 8.



PROTECTING tank with concrete saddle—Fig. 9.

and the anchor bolts secured, the triangular sections were replaced to seal the legs.

Areas of horizontal storage tanks that rest on concrete or steel saddles do not normally receive proper design attention. In most instances, both the tank and saddle are not concentric. As a result, point bearing is developed. Any movement of the tank will cause eventual failure of the paint system in the saddle area of the tank—if a satisfactory cushion is not provided. Proper painting repairs generally involve removal of the tank.

An accepted method of protection where concrete saddles are involved is shown in Fig. 9. An asphalt-impregnated felt expansion strip is placed on the saddle, with a coat of mastic applied to the upper side. Areas of the tank that rest on saddles are also liberally coated with mastic, and a glass fabric membrane is imbedded therein. When the tank is placed in the saddle, its weight will form the expansion strip to the contour of the tank, providing a moisture-proof seal. The method can be used with steel saddles. It can also be used with concrete saddles when the moisture problem is of such magnitude that protection of supports is required.

When such items as ladders, platforms and pumps are mounted on tanks, pads or other special connections should be provided to protect the paint system from damage in dismantling or replacement.

Fasteners

Early failure of protective coating systems often begins at the fastening devices, as their angular shape and sharp projections make adequate paint protection difficult.

Standard fasteners (nuts, bolts, etc.) plated with zinc or cadmium are superior to bare steel types for painting purposes. Touch-up painting may often be deferred until scheduled painting maintenance, in the event of damage to paint caused by maintenance or manufacturing operations.

Plated fasteners for general plant purposes offer several advantages outside the painting field that justify their additional cost. These are reduced consumption due to greater percentage of reuse, longer service life, and ease of dismantling.

Alloy fasteners, although too expensive for general use, are practical for severe corrosive exposures —particularly as anchor bolts where replacement or maintenance of steel-plated types is a major cost item. In most alloy fastener applications, painting as a maintenance function is eliminated. It may be necessary to guard against electrolytic corrosion.

Pipe Hangers

Pipe hangers, in general, are poorly designed for economical painting maintenance. This is due primarily to their physical shape. Improved designs are limited by physical and structural requirements, so that the problem is reduced to up-grading the material.

Metal-coated or alloy rounds and rectangular stock increase the material cost two to six times. As most pipe hangers in chemical plants are nonstandard and must be tailor made, the replacement cost will be at least equal and in most instances greater than the material differential. If maintenance painting can be eliminated or minimized to a considerable degree, sufficient justification is provided for additional material expenditure.

Alloy hangers can usually be made of smaller sections than required for standard steel—due to greater tensile strength and to a decrease in the corrosion factor.

Galvanized material is the next best alternate to steel cost-wise. When extensive heating or short-radius bending of galvanized material is necessary to form the hanger, the galvanized coating is usually destroyed. In such instances it is better to use plain steel and apply the metal coating later.

Selection of proper fasteners for use with alloy hangers may be considered a problem due to the cost and availability of alloy types. Zinc and cadmium-plated fasteners will have considerable service life when not painted and used with alloy hangers. The sacrifical qualities of zinc or cadmium-plated fasteners will cause them to fail before the hanger. Since their normal service life will be of some duration, periodic replacement will be practical.

When pipe and hangers are constructed of different materials, electrolytic corrosion may damage the pipe or cause premature failure of the hanger. The pipe should be insulated from the hanger. A common, inexpensive method is to wrap the pipe in the hanger area with a non-conducting plastic tape.

Chemical Engineering Fundamentals

Reactor Design for Complex Reactions—II

T. E. Corrigan and E. F. Young, Olin Mathieson Chemical Corp.

In previous installments (*Chem. Eng.*, Dec. 1955, p. 211 and Jan. 1956, p. 207) we have shown the effect of reactor shape (backmixing) on parallel reactions (A goes to R and to S) and on series reactions of the first order (A goes to R and then R goes to S). In this installment we'll discuss complex-series reactions.

Complex-series reactions are those which are parallel reactions with respect to one or more reactant and at the same time are series reactions with respect to the product. The commonest example of complex-series reactions is this set of reactions:

$$A + B \rightarrow R, \quad A + R \rightarrow S, \quad A + S \rightarrow T,$$
$$A + T \rightarrow U, \text{ and so forth.}$$

Here we have a parallel reaction with respect to A and at the same time a series reaction with respect to B, R, S and T.

The differential equations for complex-series reactions are difficult to integrate except for certain very special cases which we'll discuss below.

Reactions of the complex-series type are found quite often in industrial situations. This is usually the case where an active molecule is added to some compound to form a longer chain compound that is also reactive to the addition agent. Some examples of liquid-phase reactions of this type are:

- Adding ethylene oxide to water to manufacture mono-, di- and tri-ethylene glycol.
- Reacting ethylene oxide with alcohols, ammonia or other molecules that contain an active hydrogen.

Added Reactants Complicate Kinetics

A complex series reaction such as A plus B give R, and then A plus R give S, is much more complicated than the series reaction A goes to R and R goes to S. The added reactant complicates the kinetics of the reaction.

We have the reactant ratio, C_{B_0}/C_{A_0}, as an added variable which is not present in the straight series reaction. The fact that reactant A reacts with each of the products as well as with reactant B causes the relationship between C_A and time to be vastly more complicated than for either a series or parallel reaction alone.

It is virtually impossible to obtain a simple integral equation that relates C_A to holding time.

We show below a simplified flowsheet that might be applicable for a reaction of the general type

$$\begin{cases} A + B \rightarrow R \\ A + R \rightarrow S \end{cases}$$

The diagram would apply to the case where these conditions prevail:

- R is the desired product and S is of little value.
- A can not be recycled easily and therefore a high conversion of A is desired.
- The volatilities of the products are in this order: A, B, R, S.

The questions that a process engineer might ask himself about this flowsheet then, are:

- What type and size reactor?
- What temperature and pressure?
- How much, if any, excess B to use in the feed?
- How much A can be converted?

All of these are questions concerning the selection and design of the reactor. They are questions which can be answered with the help of kinetics.

Effect of Reactant Ratio

Although the presence of two reactants makes the mathematics of this type of reaction more difficult, it makes the actual physical control of the reaction easier than for a series reaction. Let's compare these two systems:

(1) $A \rightarrow R \rightarrow S$

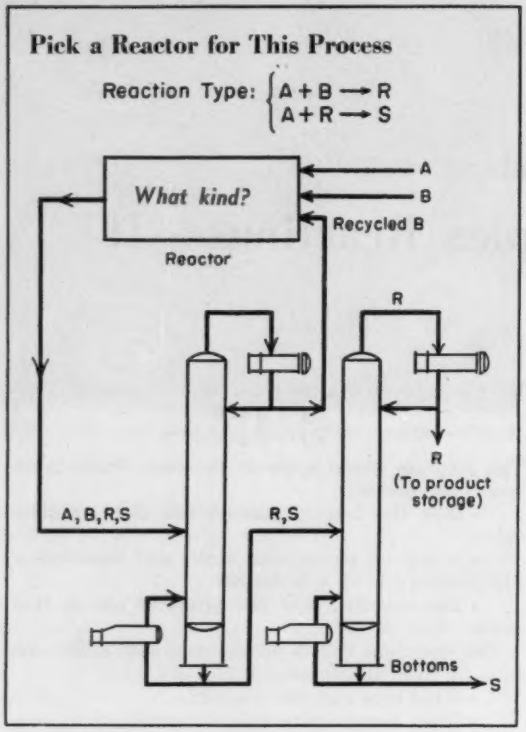
(2) $\begin{cases} A + B \rightarrow R \\ A + R \rightarrow S \end{cases}$

Suppose that in both cases R is the desired product and S is valueless. Then, the highest yield of R in both cases would be to run the reactor so as to obtain a fairly low conversion in each pass and to recycle the unreacted A.

If this were the case, the lower limit to the conversion of A per pass in either case would be regulated only by the economics of the reactor and recovery equipment cost. However, a high yield could be obtained for either type of reaction.

Suppose that reactant A is a material that is so easily decomposed that it can not be recovered in a recycle system. All A—once it goes into the reactor—is either reacted to desired product, R, converted to the unwanted product, S, or lost either in the reaction zone or in the recovery system.

If this is true, nothing can be done to obtain a high yield of desired product in the case of the straight series reaction (1). In the case of the



complex-series reaction (2), the yield of R can be increased by using a high ratio of B to A in the feed.

Thus, higher yields of R based on the amount of A charged can be obtained for the complex-series reaction provided that the reactant B can be recovered and recycled, or else is of very low cost compared with A. If the cost of B is of the same order of magnitude as A and, in addition, B can not be recycled, then the same problem holds for the complex-series reaction as for the series reaction.

Fortunately, in many commercial reactions the compound B either can be recovered and recycled (as in the case of alcohols and ethylene oxide) or else is of low value (water and ethylene oxide).

Product Distribution Equations

In most industrial reactor designs the problem is usually that of obtaining the highest yield possible while using the smallest reactor that will give the conversion and yield desired.

There are some cases where product distribution (or yield) is so much more important than reactor size that holding time is an insignificant problem. In such a case it is much more important to know the yield for any degree of conversion than to have an accurate knowledge of holding time.

Here are some examples of cases in which the product distribution is vastly more important than holding time in the reactor:

- When the reaction is extremely rapid, taking place in a matter of seconds or a fraction of a second, but where the yield is important.
- When the reactants and products are so expensive that even for moderate reactions the depreciation of the reactor has an extremely small effect on total product cost.
- When the cost of the equipment for separation of the reactor effluent, recycle and purification of the products is of a higher order of magnitude than for the reactor itself.

For the cases described above we can work out integral equations which present a complete picture of product distribution for any given feed ratio or degree of conversion but which do not involve either holding time or (V/F) as a variable. Eliminating holding time allows us to derive integral equations which are more simple than those containing time. Equations of this kind have been developed for batch, longitudinal flow and backmixing flow reactors.

Derivation for Product Distribution

An excellent presentation of the derivation and use of the product distribution equations for the straight series reaction, A goes to R to S and then to T, is discussed in an article by MacMullen which appeared in *Chemical Engineering Progress.*[1] The authors wish to acknowledge the work of J. W. Churchill,[2] T. Jenney,[3] G. A. Lessells[5] and W. C. Mills[4] in the development of similar equations for batch and longitudinal reactors.

Let's consider that the following reactions are taking place in a homogeneous system:

$$A + B \xrightarrow{k_1} R \qquad A + R \xrightarrow{k_2} S$$

Where both of these reactions are of simple order (that is, the order of reaction is equal to that indicated by the stoichiometric reaction equation), the differential rate equations are

$$-dC_A/dt = k_1C_AC_B + k_2C_AC_R \quad (1)$$
$$-dC_B/dt = k_1C_AC_B \quad (2)$$
$$-dC_R/dt = k_1C_AC_B - k_2C_AC_R \quad (3)$$
$$-dC_S/dt = k_2C_AC_R \quad (4)$$

These four equations are fundamental differential equations. They apply regardless of whether the reaction takes place in a batch, longitudinal flow or backmixing flow reactor. It is the integral form of the equation that distinguishes between different reactor types.

Distribution in Longitudinal Reactors

For batch or longitudinal flow reactors we can obtain a differential equation which relates the concentration of the major product, R, to one of the reactants, B, by dividing Eq. (3) by Eq. (2). This gives us the differential rate-ratio equation

Nomenclature (Consistent Units)

A, B	Reactants
C_A, etc.	Concentration of A, etc.
C_{Ao}, etc.	Initial concentration of A, etc.
d	Differential operator
e	2.1783
F	Feed rate
I	Integration factor

$$\frac{dC_R}{dC_B} = \frac{k_1C_AC_B - k_2C_AC_R}{-k_1C_AC_B} \quad (5)$$

This reduces to

$$dC_R/dC_B = (k_2C_R/k_1C_B) - 1 \quad (6)$$

$$(dC_R/dC_B) - (k_2/k_1)(C_R/C_B) = -1 \quad (7)$$

The next problem is to integrate Eq. (7). Luckily, this equation is of the form

$$(dy/dx) + Py = Q$$

which is one of the standard differential equations that can be found in a handbook of differential equations.

$$y = e^{-\int P dx}\int e^{\int P dx} Q\,dx + Ie^{\int P dx}$$

or in this case

$$C_R = \frac{k_1}{k_2 - k_1} C_B + IC_B^{\kappa}$$

where I is an integration factor determined by the original conditions.

Note that all reaction rate constants enter these equations as ratios, so that the absolute values can be eliminated, and a new constant kappa, κ, equal to k_2/k_1 can be introduced. Then,

$$C_R = [1/(\kappa - 1)]C_B + IC_B^{\kappa} \quad (9)$$

To define the integration constant, I, we substitute the original conditions in the equation. At $t = 0$, $C_R = C_{Ro} = 0$ and $C_B = C_{Bo}$. Therefore,

$$0 = [1/(\kappa - 1)]C_{Bo} + IC_{Bo}^{\kappa}$$

$$I = -[1/(\kappa - 1)]\,C_{Bo}^{1-\kappa}$$

Then Eq. (9) becomes

$$C_R = \frac{1}{\kappa - 1} C_B + \frac{1}{\kappa - 1} C_{Bo}^{1-\kappa} C_B^{\kappa} \quad (10)$$

Eq. (10) is the basic product distribution equation for zero recycle. It is applicable to batch and longitudinal flow reactors but it does not apply to backmixing flow reactors. It is a simple working tool that we can use to give us the concentration of product, R, that corresponds to any given concentration of reactant B.

The important use of Eq. (10) is to help us calculate the rate-rato constant, k_2/k_1, from a minimum number of batch experimental runs. Once we calculate this ratio, we can determine the product distribution by calculation for any desired conditions of feed ratio, C_{Bo}/C_{Ao}, or of recycle, C_{Ro}.

Theoretically, for this set of equations only one experimental value would be needed since κ is the only unknown in the equation. In practice, however, a whole series of experimental points will be needed to prove that Eq. (10) really applies.

Once we know C_R as a function of C_B, we can calculate values of C_A and C_S from a material balance. To summarize, then,

k_1, k_2	Reaction rate constants
P, Q	Symbols in standard differential equations
R, S, T, U	Products
t	Holding time
V	Volume
x, y	Symbols in standard differential equations
κ	k_2/k_1

How to Predict Product Distribution

Reaction type	$\begin{cases} A + B \rightarrow R \\ A + R \rightarrow S \end{cases}$
Differential equations	$-dC_B/dt = k_1C_AC_B$ $dC_R/dt = k_1C_AC_B - k_2C_AC_R$
Ratio	$\frac{dC_R}{dC_B} = \frac{k_1C_AC_B - k_2C_AC_R}{-k_1C_AC_B}$ $= (k_2C_R/k_1C_B) - 1$
Standard form	$(dy/dx) + Py = Q$ where $y = C_R$; $x = C_B$; $P = -Q/x$; and $Q = -1$.
Integrating factor	$y = e^{\int P dx}$
Solution	$y = e^{-\int P dx}\int e^{\int P dx} Q\,dx + Ie^{\int P dx}$
In original terms	$C_R = \frac{k_1}{k_2 - k_1} C_B + IC_B^{\kappa}$ where $\kappa = k_2/k_1$.
Or	$C_R = \frac{C_B}{\kappa - 1}\left[1 - (C_B/C_{Bo})^{\kappa-1}\right]$

$$C_R = \frac{1}{\kappa - 1} C_B + IC_B^{\kappa} \quad (11)$$

$$C_S = C_{Bo} - C_B - C_R \quad (12)$$

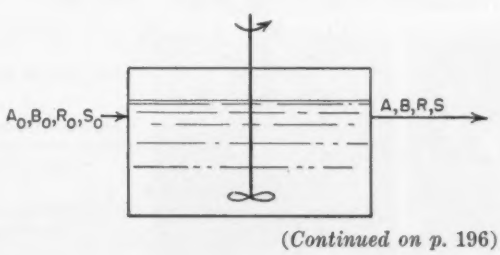
$$C_A = C_{Ao} - C_R - 2C_S \quad (13)$$

What About Backmixing?

The three equations above, Eqs. (11), (12) and (13), apply only to batch or longitudinal flow reactors. The process engineer will have to know what the effect of backmixing is to make a wise selection of a reactor. He will have to determine what the effect of backmixing will be on product distribution.

The way to do this is to calculate the product distribution for complete backmixing. For this calculation the process engineer will need a set of equations similar to the three above but which apply to continuous backmixing type reactors.

We'll derive the backmixing flow reactor equations by the usual steady-state material balances for the stirred-tank reactor shown below.



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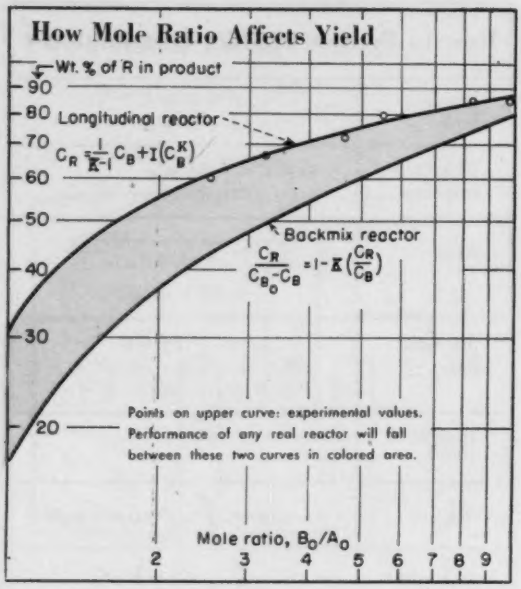

Material balance on B:

$$FC_{B_0} = FC_B + Vk_1C_AC_B$$
$$C_{B_0} - C_B = (V/F)k_1C_AC_B$$

Material balance on R:

$$FC_{R_0} + Vk_1C_AC_B = FC_R + Vk_2C_AC_R$$
$$C_{R_0} - C_R = (V/F)C_A(k_2C_R - k_1C_B)$$
$$C_R - C_{R_0} = (V/F)C_A(k_1C_B - k_2C_R)$$

Material balance on S:

$$FC_{S_0} + Vk_2C_AC_R = FC_S$$
$$C_S - C_{S_0} = (V/F)k_2C_AC_R$$

Ratio of $(C_R - C_{R_0})$ to $(C_{B_0} - C_B)$:

$$\frac{C_R - C_{R_0}}{C_{B_0} - C_B} = \frac{(k_1C_B - k_2C_R)}{k_1C_B}$$

$$\frac{C_R - C_{R_0}}{C_{B_0} - C_B} = 1 - \frac{k_2C_R}{k_1C_B} = 1 - \frac{\kappa C_R}{C_B}$$

$$C_R = \frac{C_{R_0}C_B - (C_{B_0} - C_B)C_B}{C_B(C_{B_0} - C_B)\kappa}$$

Ratio of $(C_S - C_{S_0})$ to $(C_{B_0} - C_B)$:

$$\frac{C_S - C_{S_0}}{C_{B_0} - C_B} = \frac{(V/F)k_2C_AC_R}{(V/F)k_1C_AC_B}$$

$$\frac{C_S - C_{S_0}}{C_{B_0} - C_B} = \frac{k_2C_R}{k_1C_B} = \frac{\kappa C_R}{C_B}$$

We come, then, to the basic equations for the backmixing type of flow reactor. They are:

$$\frac{C_R - C_{R_0}}{C_{B_0} - C_B} = 1 - \frac{\kappa C_R}{C_B} \qquad (14)$$

$$\frac{C_S - C_{S_0}}{C_{B_0} - C_B} = \frac{\kappa C_R}{C_B} \qquad (15)$$

or for zero recycle,

$$C_S = C_{B_0} - C_B - C_R \qquad (12)$$

$$C_A = C_{A_0} - C_R - 2C_S \qquad (13)$$

Eqs. (12) and (13) are material balance equations. Therefore, they are the same for longitudinal or for backmixing reactors.

How to Use Equations (10) and (14)

Equations (10) and (14) can be used in conjunction with standard material balance equations to determine the yield of desired product, R, for any given feed ratio, C_{B_0}/C_{A_0}, and any desired percent conversion for either a batch, longitudinal flow, or a stirred tank reactor.

An example would be in the evaluation of laboratory batch data for a reaction which goes to completion with respect to reactant A. In this case, the procedure would be:

- Obtain the experimental product distribution in a laboratory or pre-pilot plant batch reactor.
- Use Eq. (10) and a material balance to calculate the rate-ratio constant, κ, from the batch data.
- Use the value of κ and Eq. (10) to calculate the yield of R and plot R values against feed ratio, C_{B_0}/C_{A_0}. This gives the curve for a longitudinal flow reactor.
- Use κ and Eq. (14) to calculate the yield of R and plot R values against feed ratio, C_{B_0}/C_{A_0}. This gives the curve for a backmixing reactor.

To Summarize This Installment

In this month's discussion we have presented the tools that you can use to select a reactor for a complex-series reaction. These tools—like any others—will require a little skill and practice for their effective use.

Next month we'll present several illustrative problems that will show how to use these tools.

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1. MacMullen, Robert B., "Distribution Reaction Products in Benzene Chlorination—Batch Versus Continuous Process Procedures," *Chemical Engineering Progress*, Vol. 44, No. 3, p. 183 (1948).

ACKNOWLEDGEMENTS

1. J. W. Churchill, Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
2. T. Jenney, Becco Chemical Co., Buffalo, N. Y.
3. G. A. Lessels, Olin Mathieson Chemical Corp., Brandenburg, Ky.
4. W. C. Mills, Olin Mathieson Chemical Corp., Brandenburg, Ky.

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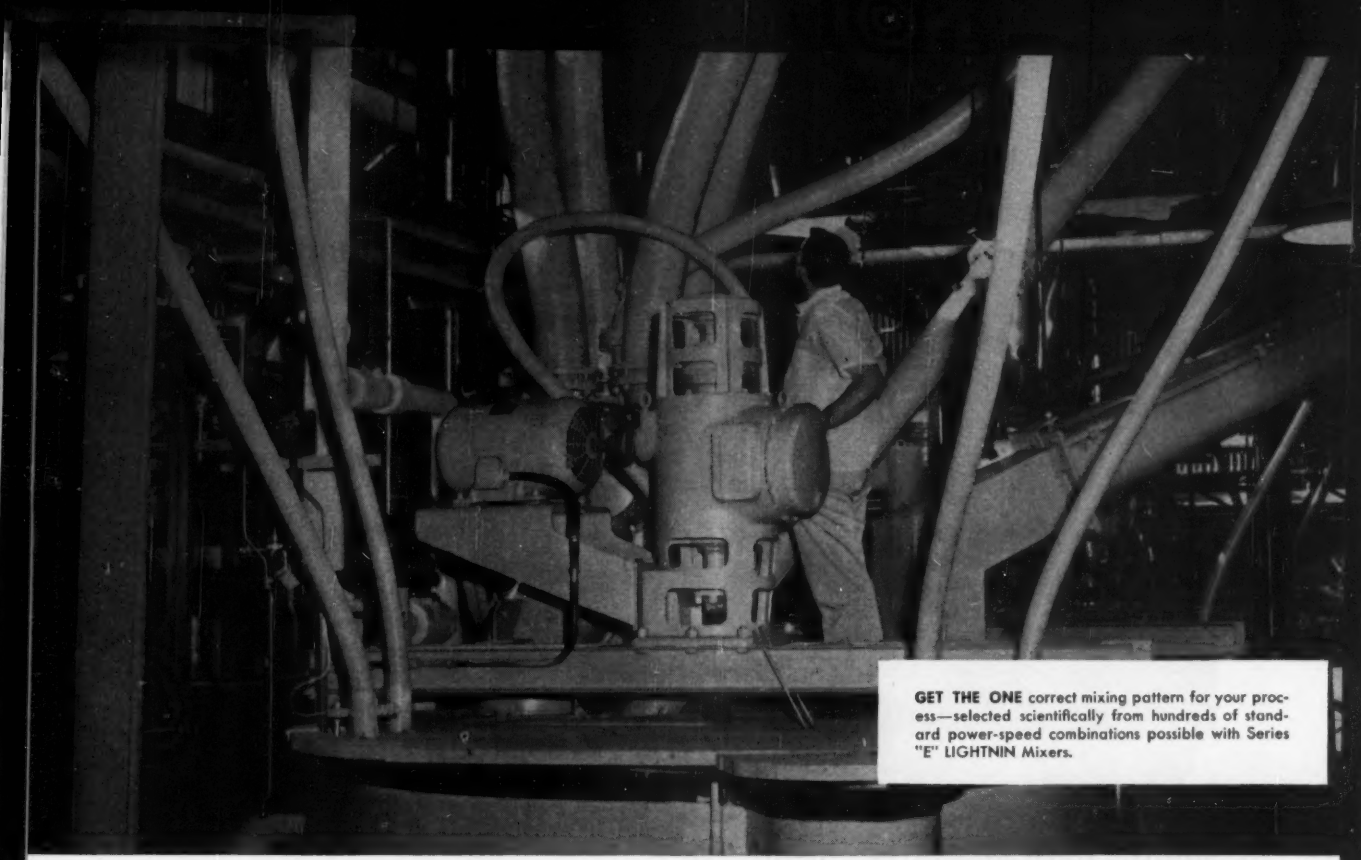

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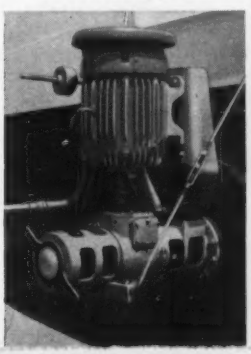

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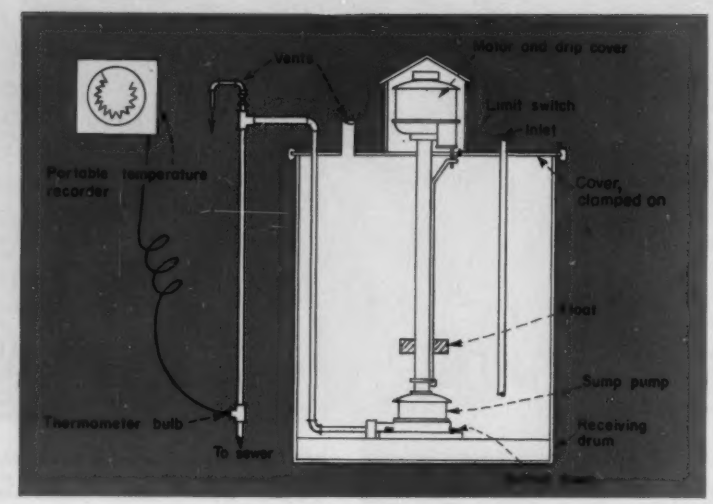


★ **Winner of November Contest**

Sump Pump Measures Steam Use

A float-controlled sump pump and a temperature recorder can be hooked up to measure condensate from steam users.

Steve Taborosi

Process Technician, Westvaco Mineral Products Div., Carteret, N. J.

Here is a method of measuring the steam consumption of process steam users which discharge condensate from a coil or jacket. It is automatic except for totalling up the flow from the discharge cycles shown on the recorder chart and it is suitable for measuring variable and interrupted flow.

The idea is simply to use a float-controlled sump pump to remove the condensate periodically from a drum in which it collects, and to detect the number of times the pump operates by means of a temperature record taken from the pump discharge line. The apparatus is calibrated by weighing the quantity of condensate discharged in one pumping cycle. Since it is easily portable, it should be recalibrated if moved to a new location.

For easiest portability, the temperature recorder can be equipped with a hand-wound clock. If the steam flow rate is more than about 1,500 lb./hr., it is a good idea to connect a second drum (not shown) in series with the receiving drum to decrease pulsations in the pumping cycle and reduce pumping frequency.

For best results the apparatus should be located as close as possible to the steam user being measured. Condensate is then piped from the user, through a trap, to the receiving drum. At a suitable upper level the pump float will trip the limit switch and start the pump, keeping it in operation until the lower limit is reached. Condensate is pumped to a convenient sewer.

As the condensate passes the bulb of the temperature recorder, its temperature increase from the warm condensate is recorded on the chart. Multiplying the number of operations shown on the 24-hr. chart by the calibration factor of the receiving drum gives the total steam consumption for the 24-hr. period. The frequency of operation gives approximately the time rate of steam use.

This method of measuring condensate is superior to bucket-time tests, especially where the steam consumption varies considerably with time. It gives a substantial reduction in labor costs in making accurate daily measurements. It can easily be arranged for transportation on a hand truck and so can be moved from location to location, and reconnected in a matter of minutes.

★ **Winner of December Contest—M. J. Auro, E. A. Andres**

"Quick Method for Heat Exchanger Design"

How Readers Can Win . . .

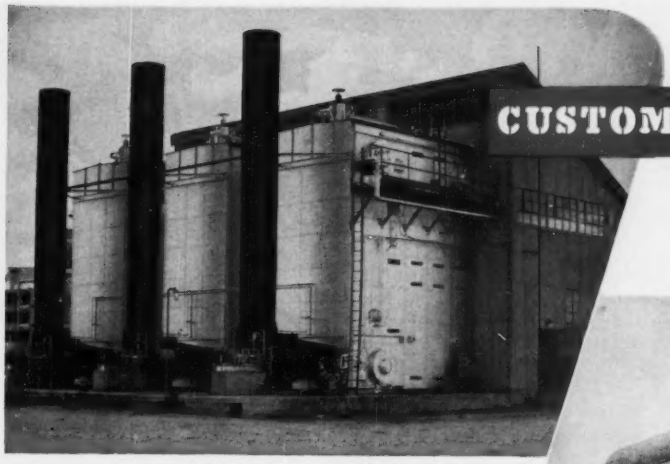
$50 Prize for a Good Idea—Until further notice the Editors of *Chemical Engineering*, will award $50 cash each month to the author of the best short article received that month and accepted for the Plant Notebook.

Each month's winner will be announced in the issue of the second following month, and published the third following month.

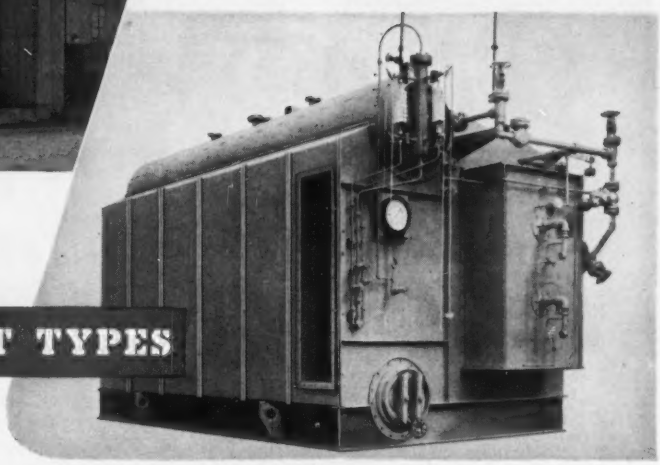
$100 Annual Prize—At the end of each year the monthly winners will be rejudged and the year's best winner awarded an additional $100 prize.

How to Enter Contest—Any reader (except McGraw-Hill employees) may submit as many contest entries as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Acceptable nonwinning articles will be published at space rates ($10 min.).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, of interest to chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.



CUSTOM BUILT TYPES



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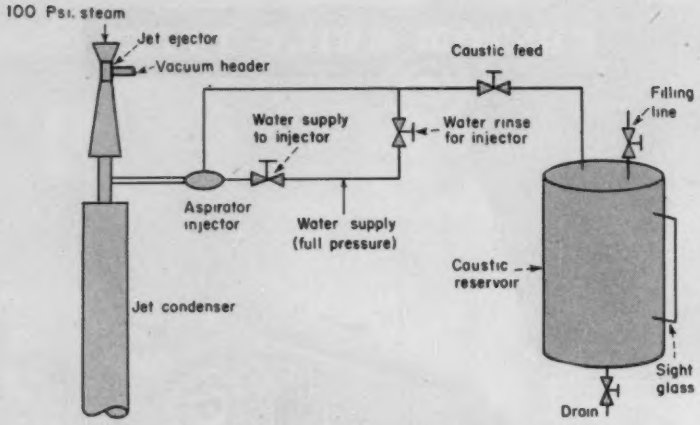


Caustic Scrubber Cuts Down Acid Fumes

Robert L. Bates

**Mound Laboratory, Monsanto Chemical Co., Miamisburg, Ohio*

An acid transfer system installed recently, employed a steam jet-ejector, followed by a water jet condenser, to produce vacuum in the system. When the jet was placed in operation, acid fumes were discharged from the condenser, and these fumes created a health hazard in the working area.

The sketch above shows how apparatus was installed to eliminate the discharge of fumes. A standard stainless steel laboratory filter pump, or aspirator, was used to inject a dilute caustic solution into the steam ejector discharge. This brought about complete elimination of the fumes by neutralization of the acid vapor, during transfer of both organic and inorganic acids.

The point selected for injection was in a short section of 2-in. pipe connecting the steam ejector and the condenser. This was because both the ejector and the vacuum header were lined with corrosion-resisting material. Although a small pump could have been used to inject the caustic, the aspirator had the advantage of economy and simplicity, and it automatically provided the desired dilution of 50% caustic feed.

The maximum capacity of the aspirator as an injector is 1/7 gpm. of 50% caustic, with a water rate of (3) gpm. However these rates of flow were found to be necessary only during evacuation of the acid receiver; during actual transfer the rates were reduced considerably.

* Author's present address is Cheminneer, Inc., Dayton, Ohio. Mound Laboratory is operated by Monsanto for U. S. Atomic Energy Commission under Contract No. AT-33-1-GEN-53.

Short Form Speeds up Radiation Calculations

John R. Cary

Development Engineer
AiResearch Manufacturing Co.
Los Angeles, Calif.

Here is a convenient and precise method for rearranging the so-called short form equations for calculating radiant heat transfer. It may also be used to advantage in calculating the "equivalent coefficient" h_r.

Factor and rearrange the fourth power equation:

$$q/A = 1.728(T_1/1{,}000)^3\theta F \times (T_1 - T_2)\text{Btu./Hr.,sq.ft.,°F.)}$$

where

$$\theta = [1 + T_2/T_1][1 + (T_2/T_1)^2]$$

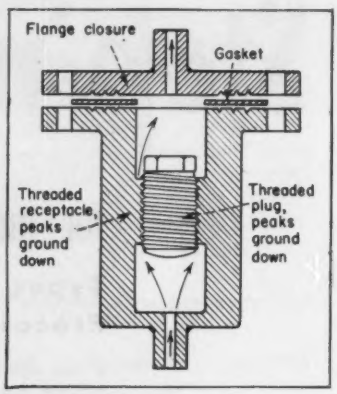
Here both temperatures are absolute.

All possible combinations of temperature may be covered in a narrow range of T_2/T_1, and therefore, of θ. For example, when $T_1 >> T_2$, $\theta \rightarrow 1$, whereas when $T_2 \rightarrow T_1$, $\theta \rightarrow 4$. Thus, considerable precision can be attained with a minimum of calculation. In the following tabulation of θ, for example, linear interpolation is accurate to well within 1%.

T_2/T_1	θ	T_2/T_1	θ
0.0	1.000	0.6	2.176
0.1	1.111	0.7	2.533
0.2	1.248	0.8	2.952
0.3	1.417	0.9	3.439
0.4	1.624	1.0	4.000
0.5	1.875		

As an example, calculate the radiant heat flux between two infinite black planes of temperatures 2,000 F. and 100 F., respectively. Also calculate the "equivalent coefficient" h_r. In the calculations below, values in brackets are exact to the significant digits shown, to demonstrate precision of factors.

$T_1 = 2{,}460$
$T_2 = 560$
$(T_1/1{,}000)^3 = 14.9(14.887)$
$T_2/T_1 = 0.228(0.2276)$
$\theta = 1.295(1.2912)$
$q/A = 1.728(14.9)(1.295)(1{,}900)$
$= 63{,}300$ Btu./Hr., sq. ft.)
$h_r = 1.728(T_1/1{,}000)^3\theta F$
$= 1.728(14.9)(1.295)$
$= 33.3$ Btu./(Hr., sq. lt., °F.)



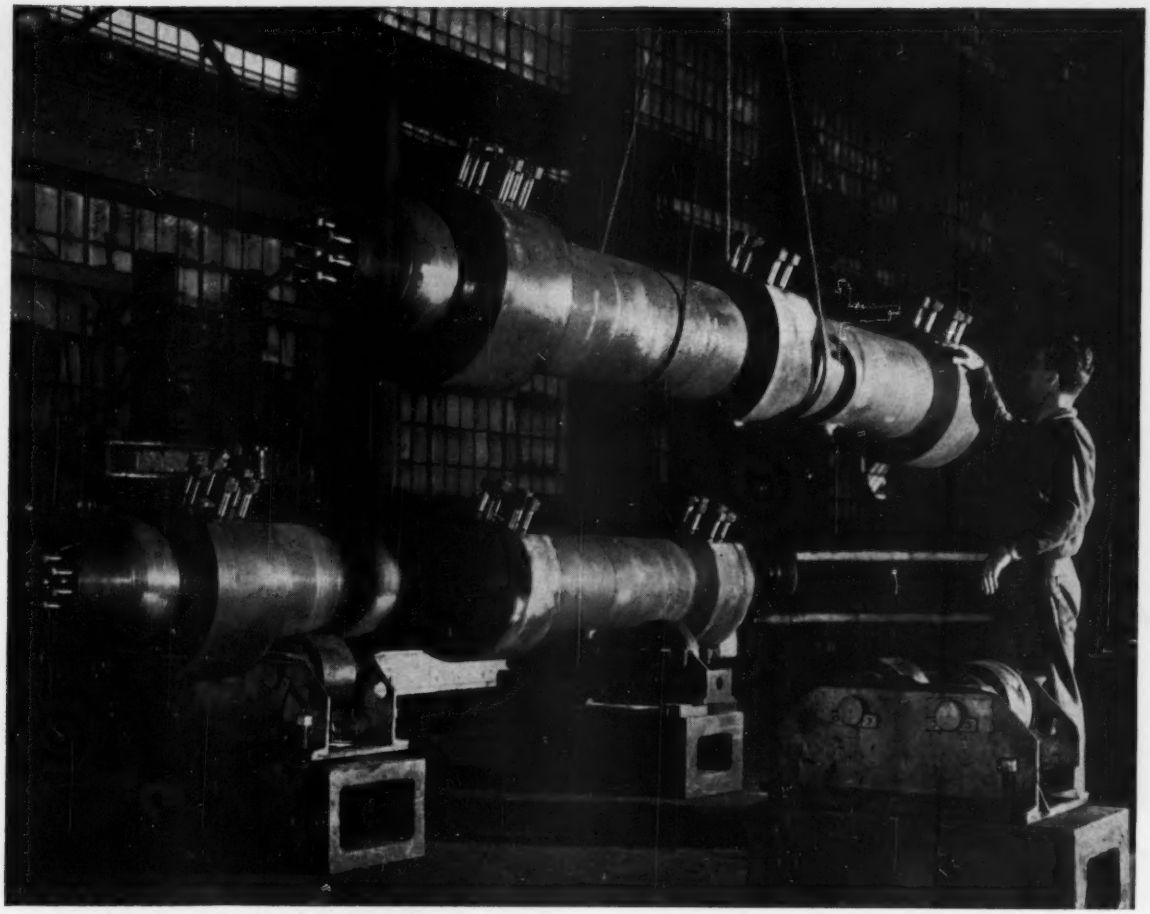
Pressure Snubber Is Easy to Make

M. Rosicarelli

Maintenance Executive, Societa Agricola Industriale Cellulosa Italiana Torviscosa/Udine, Italy

Pressure snubbers for use in damping pressure pulsations to pressure gages and flow meters can easily be constructed according to the design discussed here, whenever regular commercial snubbers are not available.

This design employs a friction tube of adjustable length which



TWO LITTLE VESSELS OF A TYPE NOT OFTEN SEEN

These unusual little fellows, called pulsation bottles, could scarcely brag about their size. Each weighs less than four tons. But they're husky; in final tests, they easily weathered pressures of 9,000 psi.

Like all forged vessels we produce, they were made from beginning to end in the Bethlehem shops. The steel was made there, of course. The forging, heat-treating, and machining were done there. So was the testing. At Bethlehem, it's an integrated service that makes possible just about every size and type of pressure vessel.

Some of the big ones we turn out are giants by any yardstick. Some of the small ones, like the pulsation bottles, are definitely in the midget class. But they're all expertly made, and no Bethlehem vessel ever leaves the shops till specifications are met in full.

When you are planning new separators, autoclaves, filters, reactors, converters, or accumulators, we'll be hapy to be of service to you. Bethlehem technicians will cooperate fully, and once the details are settled, the shops will follow through with a fine production job.

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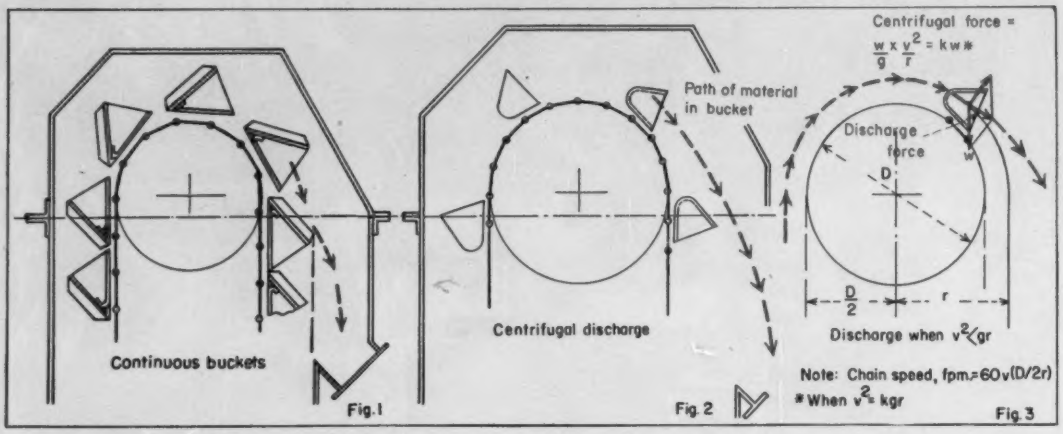
consists of space produced deliberately between a threaded plug and a correspondingly threaded receptacle. The plug and receptacle are fairly coarsely threaded, using a machine thread, or a running pipe thread. After threading, the peaks of the threads on both the plug and the receptacle are lightly ground off so as to produce a little "crest clearance" when the two are screwed together. The length of passage so formed can be regulated by screwing in more or less of the thread. Any pulsating fluid compelled to pass along the screw thread is thus damped of its pulsations.

The design indicated has a high-pressure enclosure, closed with bolting, a high pressure flange, and a gasket. Connections are welded.



What Is Best Speed for Your Bucket Elevator?

Chesman A. Lee

Engineer, U. S. Steel Corp., South Chicago, Ill.

In handling bulk chemicals and fertilizers, as well as many organic materials, dust is often a controlling factor. Such materials are often handled with bucket elevators, which can be a problem with dusty materials. Therefore, it is well to have a certain background knowledge of the principles of their design, although our purpose here is not to develop a system for design, but rather a basis for plant discussions.

A little background of this sort is especially helpful in dealing with production people who always want more capacity and have sometimes been known to speed up elevators without getting engineering advice. What we discuss will be limited to "continuous-bucket" and "centrifugal-discharge" elevators.

It has been claimed that the continuous-bucket elevator (Fig. 1) is inherently not dusty. My viewpoint is a different one, namely, that the design inherently makes for dust unless the speed is held down. That is why the catalog speed is only 125 fpm. An elevator of this type should have the best speed when installed. The assumption is that it was engineered completely by the manufacturer.

The centrifugal-discharge elevator (Fig. 2) is a somewhat different story in that it is more flexible. It may be dusty, or not, depending on the speed. When $v^2 = gr$, the centrifugal force is numerically equal to the force of gravity and the material is in equilibrium at the top of the head-wheel. Only in high-speed grain-elevator work is this velocity exceeded, and then only with special designs. For example, the casing head-section will be curved into a volute, with the spout angle flat. Material discharges before reaching top of wheel, and is swept around to the spout.

For other materials, however, discharge is effected by the resultant of the centrifugal and gravity components, as shown in Fig. 3. Discharge starts at an angle (from the top of the wheel) whose cosine equals k in the reduced speed formula $v^2 = k\,g\,r$. Conventional speeds (see, e.g., Link-Belt Catalog 900) agree approximately with $v^2 = 0.82\,g\,r$; and discharge starts at 35°—or a little later with materials that pack. Experimental work with photographs taken of the discharge show that many materials have an apparent discharge angle of about 45°.

With such materials, it is possible to increase the speed a little for more capacity—9% is a good limit. For dusty materials the speed can be reduced a little with

NOMENCLATURE

- D Head-wheel diameter, ft.
- g Acceleration of gravity, ft./sec.^{2}
- k Cosine of angle where discharge starts $= v^2/gr$.
- r Radius of bucket center around head-wheel, ft.
- v Velocity of material, fps.
- w Weight of material in bucket, lb.

Pelleting Solves Many Processing Problems

More and more processing engineers are profitably solving many problems by observing the following basic fact:

> *Multiple benefits are gained by forming a hard "shell" around materials and compressing them so that the surface areas are reduced.*

This is accomplished through pelleting, which can be successfully applied to ammonium chloride, insecticide dusts, clay, citrus meal for use as an antibiotic carrying agent, fertilizer, granular hygroscopic products, and many other materials.

Pelleting reduces or eliminates the dusting characteristics of materials.

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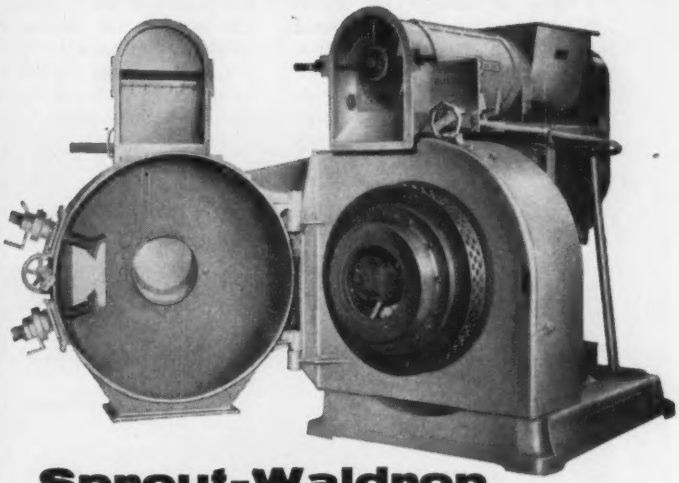

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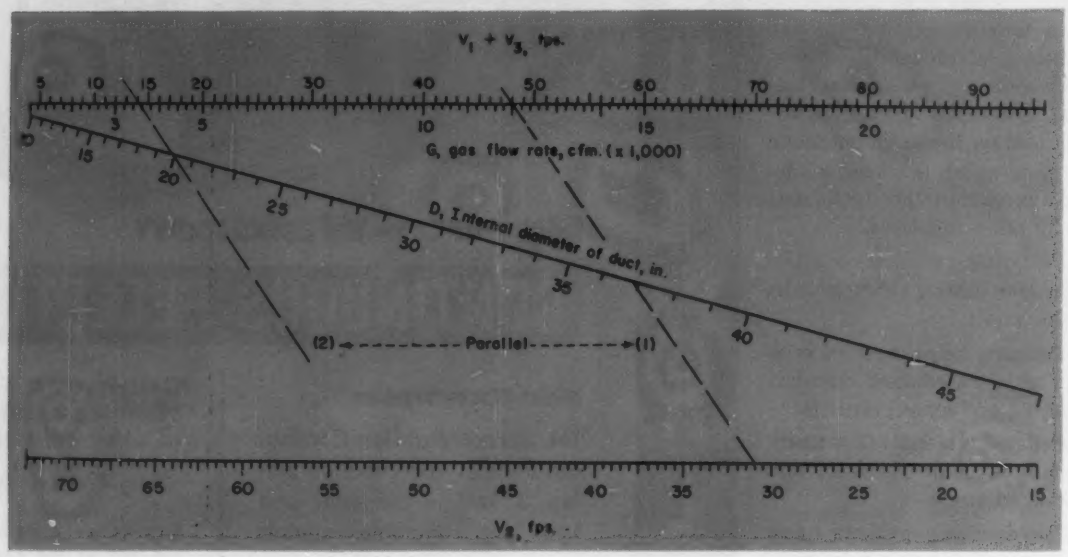
noticeable reduction in dust. The decrease can be 9% and still get a good discharge, but at lower capacity, of course.

I know of cases where elevators have been speeded up beyond reason, with excessive dusting, power consumption and maintenance, yet a doubtful increase in capacity. In another case, however, we wanted more capacity and to our surprise found the elevator was operating at reduced speed. The plant man did not want a speed-up, fearing that his loose and finely ground material would not discharge, but would sweep back down the casing. We speeded up the elevator as required and got a good discharge without dust.

The answer of course, lies in the method of discharge. Referring back to Fig. 3, material does not merely pour out of the bucket, but is actually thrown out at higher than bucket speed.

A centrifugal-discharge elevator can be selected on the basis of catalog data, bearing in mind that some range in speed is possible, depending on the nature of the material.



Alignment Chart Finds Gas Flow Rate in Circular Ducts

Pawel Cichy

Chemical Engineer, Aluminum Laboratories, Ltd., Arvida, Que., Canada.

Average velocity of a gas in a circular duct is often determined quickly by a three-point Pitot tube traverse. The location of the three points and the formula giving the average velocity in the duct are given by Gauss's method[1, 2] for numerical integration. Once the Pitot tube readings are made the gas velocities can readily be obtained from tables.

The formula giving the average velocity from the three-point traverse is

$$V_{avg} = \frac{5}{18}(V_1 + V_3) + \frac{4}{9}V_2$$

where V_1 = velocity at point—0.88 r from center of duct, fps.; V_2 = velocity at center of duct, fps.; V_3 = velocity at point 0.88 r from center of duct, fps.; V_{avg} = average velocity in the duct, fps.; and r = radius of duct, in.

Knowing the average velocity, the gas flow rate can be obtained from the formula

$$G = 0.327 D^2 V_{avg}$$

where G = gas flow rate, cfm.; and D = diameter of duct, in.

From the above two equations the N chart shown above can be constructed.

The use of this chart is illustrated by the following example. The velocities found in a 20-in. duct are $V_1 = 25$, $V_2 = 31$, $V_3 = 23$ fps. On the $V_1 + V_3$ axis we locate point 48, which we connect with point 31 on the V_2 axis. We then draw a parallel to this line, going through point 20 on the D axis. Its intersection with the G axis gives us the gas flow rate as 3,550 cfm.

For values not given in the chart, its usefulness can be extended by multiplying or dividing $V_1 + V_3$, V_2 and G by a constant provided that the diameter retains its value unchanged.

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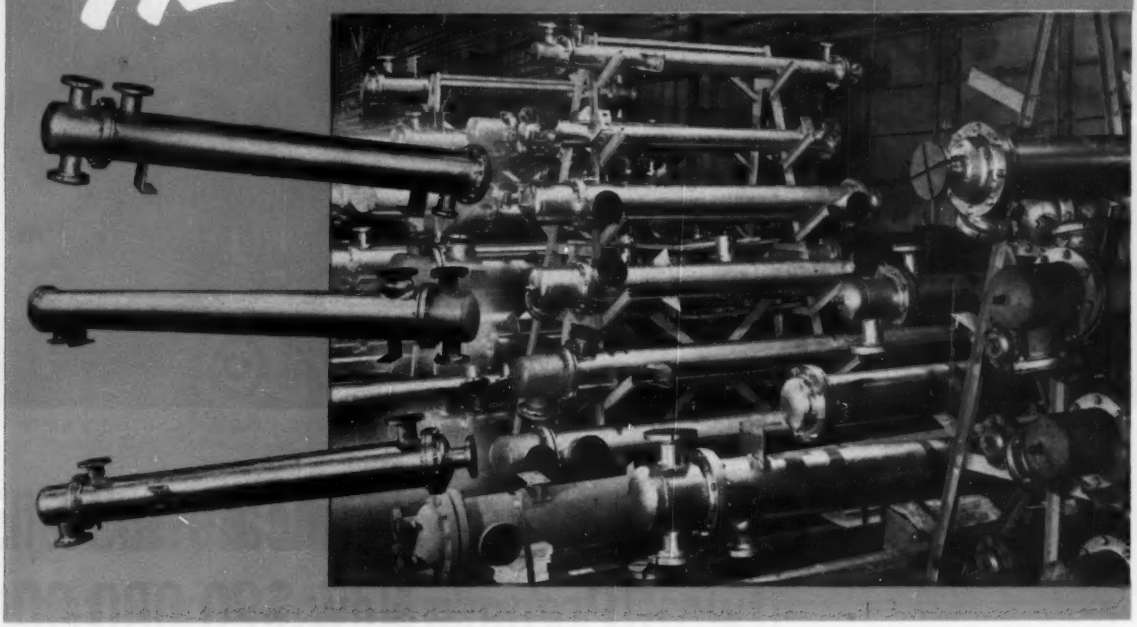
1. Sherwood and Reed, "Applied Mathematics in Chemical Engineering", p. 272-277, McGraw-Hill Book Co. Inc., New York.
2. Schneider, R. W., *Chem. Eng.* **56**, 112-3 (1949).

Struthers Wells

Standard HEAT EXCHANGERS



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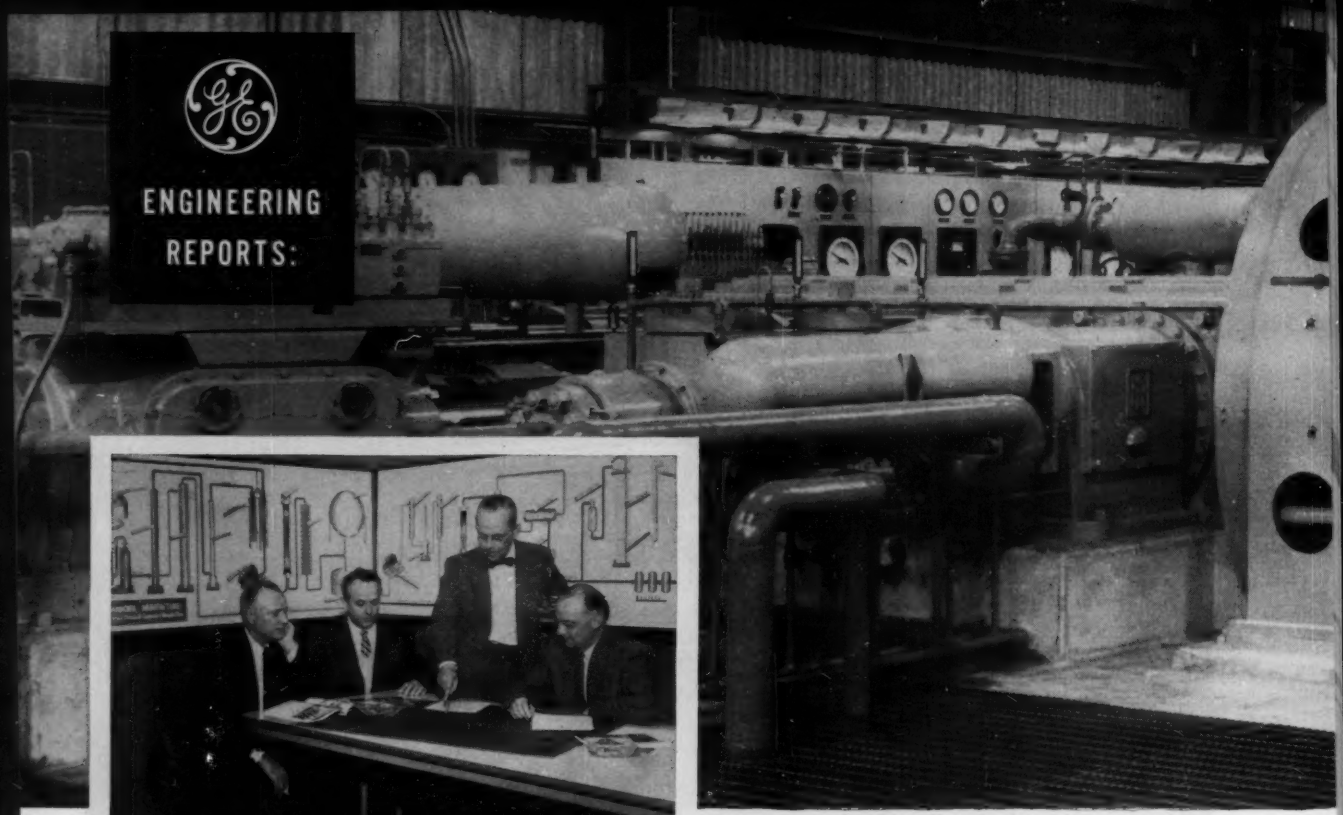
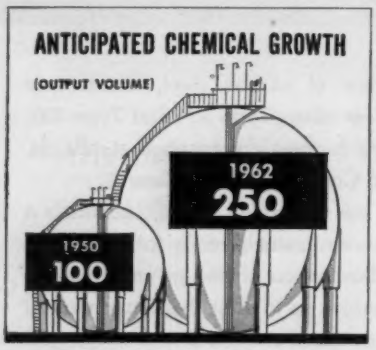


VICE PRESIDENT and plant manager J. G. Carriere (standing), discusses plant features with General Electric's H. F. Hemker, Grace Plant Superintendent Charles Dougherty, and G-E Service Engineer John Thrithart.

Grace Chemical* Installs Prepare New $20,000,000

General Electric Engineering Services helped Grace Chemical design, install flexible electrical system to handle present and future power loads

*Grace Chemical Co., division of W. R. Grace & Co.



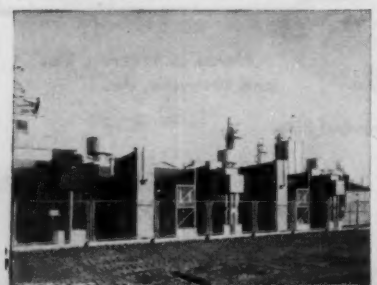
BY 1962, it is expected that the chemical industry will more than double 1950 production levels. In graph, 1950 production equals 100.

Source: Manufacturing Chemists Assoc.

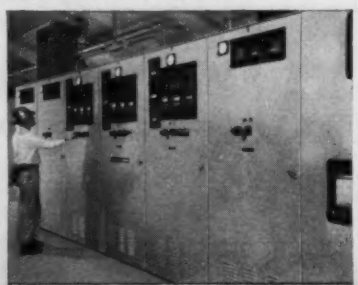
PLANNING NOW for future production is a major consideration in the fast-growing chemical and allied products industry. This booming industry is growing at the rate of about 7% per year (all industry growth averages only 3%) and the annual value of chemical products is now over 7% of the value of the nation's entire manufacturing output.

THE GRACE CHEMICAL COMPANY, a division of W. R. Grace & Co., anticipated growth and constructed the new ammonia-urea plant at Memphis, Tenn. Now in operation, the plant, described as one of the most modern in the industry, has an engineered electrical system that was planned to meet present

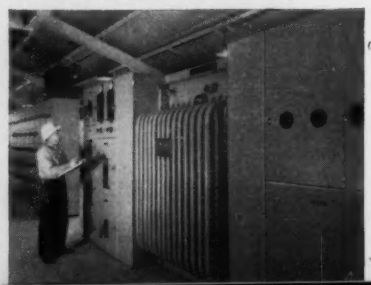
INCOMING POWER is "stepped down" by three G-E 7500-kva, three-phase, power transformers in the main substation. Whole plant uses grounded neutral system.



COST SAVINGS and operating convenience were obtained by locating 12,500-v, switchgear (below) inside, transformers (photo at left) outside the powerhouse.



POWER is stepped down to 480 volts for the plant's process drives by this 1000-kva load-center unit substation, one of four installed in the plant.



ONE OF THE OLDEST industrial chemicals, ammonia, has found new uses in synthetic fibres, vitamins, rocket and missile fuel, and various chemical intermediates. In Grace's modern process, three huge 3000 hp G-E motors drive Ingersoll-Rand gas compressors.

Engineered Electrical System to Help Plant for Rapid Industry Growth

production requirements yet flexible enough for future expansion.

Cornerstone for expansion is the electrical system—designed and installed with the help of G-E engineering. A G-E service team headed by W. A. Raines, Manager—Industrial Sales, N. Y., and H. F. Hemker, Manager, G-E Memphis Office, worked closely with the Foster Wheeler Corp., main contractors, and Grace Chemical personnel to design and install the G-E electrical equipment that met the Grace requirements.

VICE PRESIDENT JOHN G. CARRIERE of the Grace Chemical Co., Plant Manager of the new installation, summed up a discussion of the plant facilities with these words . . . "G-E engineering services did an excellent job for us; the electrical system has performed superbly."

WHEN YOU EXPAND OR MODERNIZE, G.E. has complete engineering services that will help you co-ordinate an electrical system designed for your specific needs. These specialists work with you and your consultants to prepare your plant for present and future production requirements. Get in touch with your nearest G-E Apparatus Sales Representative early in your planning and write for bulletins GED-1966B and GED-2244 to General Electric Co., Section 681-10A, Schenectady 5, N. Y.

†*Registered Trademark of General Electric Co.*

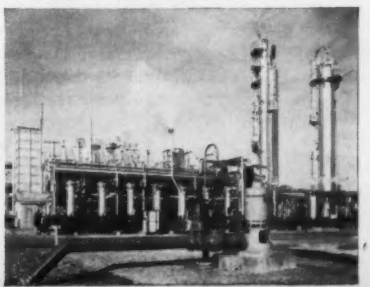
Progress Is Our Most Important Product

GENERAL ELECTRIC

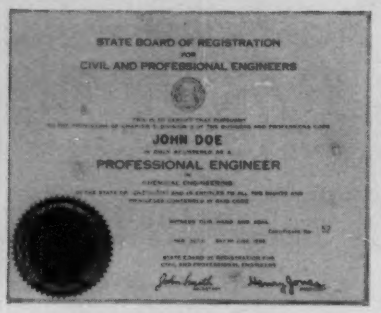
CONTROL for G-E compressor motors is provided by 4160-kv, metal-clad switchgear. Other electrical equipment also receives power through this line-up.

EASILY EXPANDED G-E motor control centers are co-ordinated with switchgear to provide complete selective tripping for the electrical system.

WATER-WELL PUMP is driven by 60 horsepower, G-E Tri-Clad† vertical motor. In the background is Grace Chemical Company's gas mixing equipment.



EDITED BY H. T. SHARP



- **Getting a professional license can give a real boost to an engineering career, but . . .**
- **Passing the written exam often proves a problem. Here's an expert . . .**
- **Drawing on long experience to give you help. For proper preparation is . . .**

How You Can Pass the Registration Exam

John D. Constance

ENGINEERING registration examinations try to learn if the candidate engineer understands basic scientific and engineering principles and if his training and experience have taught him how to use these to solve problems.

This is a pretty tall order, and the various state examining boards are developing many different types of tests in their efforts to fill it. Their prime tool is the written examination.

And it's the prospect of this written exam which often causes applicants considerable anguish. This is understandable. The exam is usually pretty rough—it has to be to do its job of separating those competent enough to be licensed to practice professional engineering for the public from those less qualified—but it needn't be frightening.

Knowing what to expect and how to prepare for it will not only ease the mental strain but will also help you do a better job of taking the exam.

Starting on p. 212, there's a comparison of the examining practices of the various state boards. While these vary considerably in operating details (for instance; Arkansas and many other states give two 8-hr. tests, the first on general principles, the second on a specific branch; New York, on the other hand, has three 4-hr. tests), they all exhibit a surprising degree of uniformity.

Questions and problems generally come from colleges, professional engineers and the board members themselves. And papers are generally graded by those who compile them and, however they may well be reviewed by the board.

Since 1931 the various state boards have made a concerted effort to get some uniformity in the type, quantity and quality of the questions posed in the written exam. This, obviously, is essential to facilitate free flow of engineering talent and services across state lines. Unfortunately, their efforts haven't been completely successful. But reciprocal licensing, resulting from equivalent written examinations, is common practice among a majority of the states and efforts to extend this to all haven't slackened.

Results, too, are similar. Most states come pretty close to these averages:*

- 71% of all applicants are registered.
- 24% fail the test or are denied on other grounds.
- 5% fail to report for the exam or have action pending for one reason or another.

Of the 71% registered:

- 60% were by education, experience, reciprocity, endorsement, etc.
- 3% were by personal interviews.
- 6% were by oral examination.
- 31% were by written examination.

In some states, state law requires all applicants to appear before the board for personal interviews. In most, this it not a general rule, though personal interviews may be used to complete the man's experience record, make a board judgment in borderline cases or, occasionally, at the specific request of the candidate.

Personal appearances have their good points, but they are very time consuming and often unfair to the applicant, since to be of real value it should be held before the entire board and this is often impossible.

Recognizing this, studies are now underway to give a different type of test to older, more experienced engineers—those most often called for personal interviews. This would not be an easier exam. But it would be more comprehensive, in keeping with his more diversified experience and to give him more opportunity to demonstrate his

JOHN D. CONSTANCE *is an expert in preparing men for professional licensing exams. For some 13 years now, he's been teaching refresher courses, publishing study aids and running his own guidance service for license-minded engineers. Last August in* YOU & YOUR JOB *he discussed the general requirements for registration.*

* From 1953 figures for all states according to the National Council of State Boards of Engineering Examiners.

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ability to make engineering judgments.

In any event, the examination is a sampling process, since it's impractical to examine every candidate in all details of his knowledge or all phases of its application.

Those who compile the tests strive for good distribution in their questions and try to frame them so answering requires ability in using the tools of the profession and not merely a facile memory.

Unlike School-Type Tests

Hence, registration examination are rarely the kind you remember from college—which aimed to find out how well you mastered a subject you had just been taught.

Commonly, the written test is split into two parts, given on successive days. The first probes into your grasp of engineering fundamentals of all branches; the second tries to measure your ability to apply these, as well as to rate the extent and quality of your experience in your branch.

Nearly all state boards conform on the pattern of the first day's questions. These cover that material with which all engineers can be expected to be familiar and which forms the common core of all engineering curricula in college. It includes:

- Mathematics through the calculus.
- Engineering economics and economic selection.
- Basic chemistry.
- Principles of physics.
- Thermodynamics.
- Fundamentals of generating and transmitting electricity.
- Mechanics, including both statics and dynamics.
- Strength of materials and the theory of structure of matter.

Math Is Basic

The basic importance of mathematics to the expression and application of engineering problems, along with the ease with which mathematical problems can be devised have led to the common use of such problems in registration exams.

But since these problems often reveal nothing except the candidate's skill at mathemetical manipulation, which is far less important than the ability to use math to solve actual engineering problems, some boards give no problems of this type at all. They rely on problems in application to reveal the candidate's mathematical prowess.

This can permit more efficient use of time, and allow the examination time to be cut. Some states have tried it successfully.

Experience on Trial in Last Part

The second day's problems usually require the engineer to show proper judgment in using correct formulas, economical considerations and practical approaches. Problems are so worded that the candidate must rely on experience to develop a solution.

Unlike questions in the first part which test his skill with math and his knowledge of engineering theory, the candidate will often find an essay type question, or a critical description of a project on which he's had experience, putting his judgment on trial.

Here's an example:

Give at least four different methods of removing dust particles from a gas and compare their engineering requirements.

Given a gas of 50,000 cu. ft./min. flow, 50 lb./min. of hygroscopic dust, averaging 10 microns in size, at 200 F. and with a dewpoint of 50 F., what method would you recommend and why?

An inexperienced man would probably fumble such a problem, while the engineer with only a few years experience could probably field it with ease. Since the test tries to measure the minimum qualifications for registration, questions are usually of this quality.

In Wisconsin, the candidate is apt to find a few questions on ethical principles in this part of the test. This has long been a neglected area, but Wisconsin's move is part of a trend that is slowly developing. New York stresses engineering economics in the third part of its three-part exam. And throughout the country, material on business law and contracts—which many schools include in their engineering curricula—is likely to appear in the exam.

Preparing for the Exam

The typical licensing candidate spends a lot of time and money preparing for his test. Generally, some serious thought in planning this preparation can keep it from being wasted. Success in the exam depends in great measure on how you go about it.

Experience shows that the average candidate who fails to pass has tried a "cook book" approach to the test. He'll study sample problems hoping that he'll be able to spot similar ones in the test, then he'll only have to stick the variables in a formula and grind out the answer. But it never seems to work out that way.

Although the core of the exam remains essentially unchanged from year to year, the examiners are pretty skillful in changing the window dressing, and under the pressure of the test, the "cook book" man generally misses the basic requirements of the problem and comes up with the wrong recipe.

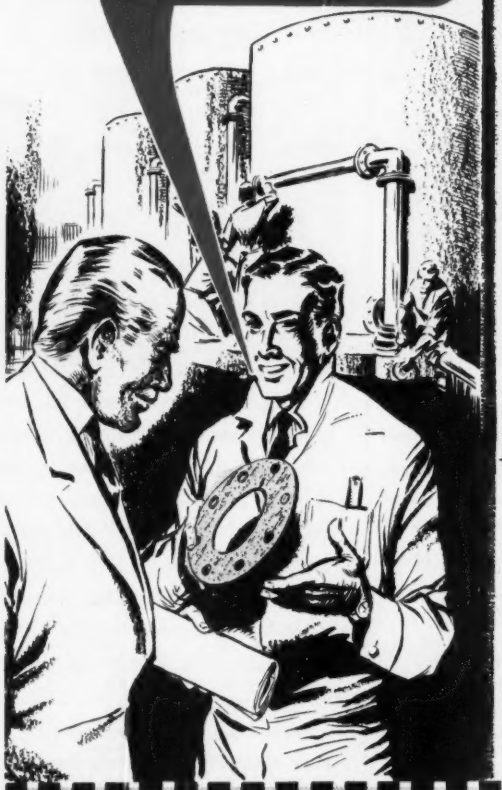
There just isn't any easy substitute for faithful attendance at refresher courses, attention to home assignments, etc., in your preparation.

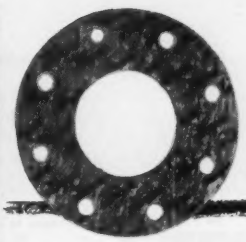
The boards expect the applicant to use those sources of information with which he is

Next Month: How to Organize for Top Performance

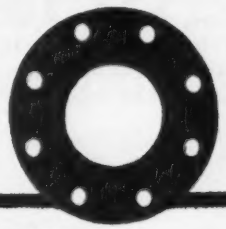
Over the past several years the problems of organizing a group of people to do a job have claimed much attention from management experts. The principles and practices which they've developed are sure to help you whether you set yourself to organizing a research task-force or an entire company. And you can even use them in organizing your own work. Next month we'll distill the latest and best of this thinking for your use. Look for it in March's You and Your Job.

Let's Klingerise our plant and stop all these breakdowns!





"KLINGERIT" The universal sheet packing for super-heated and saturated steam, acids, alkalis, and other chemicals, oils, spirits, solvents and hydrocarbons, hydraulic pressures, compressed air and other gases.



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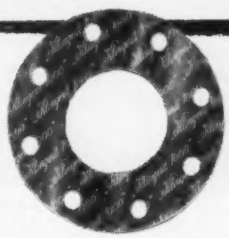

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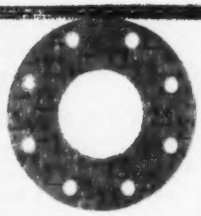

"RK" For most conditions of pressure and temperature encountered in general engineering practice. It is suitable for super-heated and saturated steam, water, compressed air and other gases and most chemicals.

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familiar. College texts, provided they aren't out of date, are usually good sources of review. Textbook publishers are happy to supply lists of reference texts, too. Compilations* of past examination problems are available from the secretary of your state board. Used to aquaint you with the type of material and terminology used in the exam and to define the areas of interest to the board, can prove quite helpful.

Past exams also contain valuable data and constants which you can use to advantage in working your test. They give you a chance to clear up ambiguous wording and spot impractical approaches to various types of problems—and, in the process, build your confidence in your ability.

Approaching the Test

There's an art to taking the professional licensing examination, an approach that has worked for many applicants.

If you're taking a test of the "open book" variety, carry only a minimum number of books into the examination room. Some engineers actually carry trunks full of reference volumes to their seats—then waste most of their time juggling them from knee to knee and thumbing through them hunting answers. In addition, they annoy those around them, and examination rooms are generally crowded these days.

Some states (Illinois is one) have set up a list of approved reference books of the handbook type and allow candidates to use only books on the list in the test. Indiana tried a closed-book exam and compiled a set of formulas which were published and distributed to candidates in advance. But it found that some applicants didn't use standard symbols and got all tangled up in the nomenclature and became confused in problems they knew how to solve.

But whether the exam is open book or closed, all boards permit use of the slide rule in working out answers. Detailed in-

* The author publishes various study aids, including compilations of past exam problems and lists of worthwhile study and reference books. His address is 625 Hudson Terrace, Cliffside Park, N. J. Another compilation of exam questions and answers has just been published by McGraw-Hill, New York.

How State Examination Procedures Compare

This synopsis of state examining board procedures summarizes and compares the methods used to conduct the examinations for professional licensing. It also lists the passing grade and the type of registration (whether by branch or simply as professional engineer) granted.

In . . .	The Exam Is . . .	Run by . . .	Passing Grade is . . .	They Interview . . .	To Register As . . .
Alabama	8 hr. physics, mechanics, hydraulics theory of structures, 4 hr. fundamentals, 4 hr. professional	Proctors	70%	About 50%	P.E.
Alaska	By exemption	———	——	No	Branches
Arizona	Two 8-hr. exams Basics and branch	Proctors	60%	No	P.E.
Arkansas	8 hr. general, 8 hr. specific	Honor	70%	Yes	P.E.
California	8 hr. fundamentals, 8 hr. professional	Proctors	70%	No	Branches
Colorado	8 hr. fundamentals, 8 hr. professional	Proctors	70%	No	P.E.
Connecticut	3 hr. closed & 3 hr. open book on fundamentals, 2 exams 3 hr. each, open book on branch	Proctors & Honor	70%	No	P.E.
Delaware	4 hr. fundamentals, 4 hr. professional	Proctors	70%	Yes, if necessary	P.E.
District of Columbia	8 hr. fundamentals, 8 hr. professional	Proctors	——	No	P.E.
Florida	6 hr. each, ½ day theory, ½ day general, 1 day practice	Honor	70%	No	P.E.
Georgia	3 hr fundamentals, 3 hr. professional	Proctors	60%	No	P.E.
Hawaii	4 hr. basic, 4 hr. general, 4 hr. professional	Proctors	70%	No	Branches
Idaho	16 hr. max. written 2 days, 2 parts. Also oral 4 hr.	Board	70%	No	P.E. with branch noted
Illinois	8 hr fundamentals and basics E.I.T.,* 8 hr. professional	Proctors	70%	Yes, for reciprocity	P.E.
Indiana	5 parts, first 3 4 hr. each, part 4 1 hr., last part 3 hr.	Proctors	70%	No	P.E. under branch
Iowa	8 hr. fundamentals, 8 hr. branch	Proctors	70%	Yes	P.E. with branch
Kansas	8 hr. fundamentals, 8 hr. practice, 2 sections each	Proctors	70%	No	P.E.
Kentucky	8 hr. fundamentals, 8 hr. branch	Proctors	70%	Yes	Branches
Louisiana	8 hr. fundamentals, 8 hr. branch	Proctors	70%	No	P.E.
Maine	Two 3-hr. exams fundamentals, two 3-hr. exams on practice	Proctors	Weighted	No	P.E.
Maryland	8 hr. basics, 8 hr. professional	Proctors	Set by board	No	P.E.
Massachusetts	Fundamentals as required by experience. (Refer to statute)	Proctors	70%	No	P.E.
Michigan	4 hr. fundamentals, 4 hr. law & ethics, 8 hr. practice	Proctors	70%	No	P.E. with branch designation
Minnesota	4 hr. fundamentals, 4 hr. basic, 8 hr. professional	Proctors	65–75%	Yes	Branches
Mississippi	4 hr. basics, 4 hr. application, 8 hr. professional	Proctors	70%	Yes, but by examinees only, not board	P.E.
Missouri	4 hr. basics, 4 hr. application, 8 hr. practice	Proctors	70%	Yes	P.E.
Montana	6 hr. fundamentals, 8 hr. professional, ⅓ theory, ⅔ practical	Proctors	70%	No	C.E. only
Nebraska	Fundamentals and professional	Proctors	70%	Yes	P.E.
Nevada	8 hr. fundamentals, 8 hr. branch	Proctors	70%	Yes	P.E. with branch

* E.I.T. (Engineer in training) are any who pass the fundamental and basic parts of the examination but who have not had four or more years of approved experience. (cont'd).

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CHEMICAL ENGINEERING NEWS

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Expansion joints of TEFLON® are chemically inert – exceptionally strong

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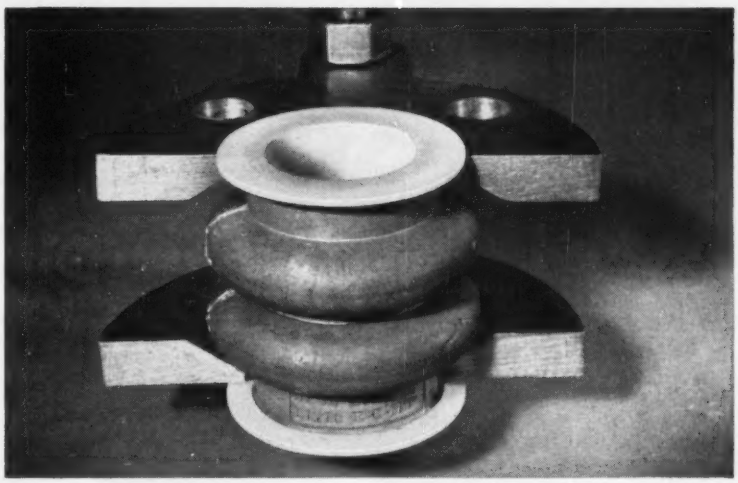
"Alathon" demonstrates unusual resistance to chemical reagents. It is substantially unaffected by concentrated hydrochloric, sulfuric, or hydrofluoric acids at room temperature. While permeable to certain organic acids and to some essential oils, it is not altered chemically or mechanically by these materials. The chemical and physical properties of "Alathon" remain unchanged with age, assuring you of long, trouble-free service.



This expansion joint lined with "Teflon" is designed for service at elevated temperatures and pressures. It is inert to all normally encountered industrial chemicals. *(Manufactured by John L. Dore Co., Houston, Texas.)*

Where operating conditions are toughest in the chemical industry, parts of "Teflon" tetrafluoroethylene resin assure dependable operation. Du Pont "Teflon" is not attacked by any chemicals normally encountered—only alkali metals and fluorine under special conditions affect "Teflon." And, conversely, "Teflon" will not contaminate the products in contact with it. The operating temperature range of "Teflon", coupled with its chemical inertness, provides new opportunities for designers of process equipment.

A typical application is the John L. Dore Expansion Joint lined with "Teflon." This joint is designed for service at elevated temperatures and pressures. It features an "L"-shaped steel sleeve imbedded in the flange to prevent distortion. Bolt pressure is transmitted directly to the "Teflon" extending over the flange face, thus assuring a leak-proof seal against the companion flange. The "Teflon" is the only material touched by line commodities.

It will pay you to investigate the possibilities of using "Teflon" in your own application since no other flexible material can serve you so well over such a wide range of conditions.

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Please send me more information on the Du Pont engineering materials checked: ☐ "Teflon"* tetrafluoroethylene resin; ☐ "Alathon"* polyethylene resin; ☐ "Zytel"* nylon resin; ☐ "Lucite"* acrylic resin. I am interested in evaluating these materials for_____

NAME_____

COMPANY_____ POSITION_____

STREET_____

CITY_____ STATE_____

TYPE OF BUSINESS_____

struction on what to bring are given each candidate. Some means of identification, such as a photograph, is necessary and usually presented at the door. In addition, the following will be useful:

- Watch.
- Supply of sharpened pencils and a fountain pen with ink.
- Slide rule and/or log tables.
- Graph paper (8½x11 in.).
- Paper for scratch work.
- Ruler, scale, triangles and protractor.
- Reference books, as directed.

Some of these items are obvious—but that doesn't seem to keep them from being forgotten when they're needed.

When you get to the room, seat yourself in a well-lighted section. It will help you ward off fatigue.

Taking the Test

Before attempting to solve any problems, read them all through and check off those which seem most familiar. This should take no longer than ten minutes.

Then divide your remaining time equally among the problems which you decide to work and stick rigidly to these time allotments. The instructions will tell you how many must be solved successfully to pass. Boards rarely pose problems that take more than 20-45 min. to work, and many will take less. In most states, all answers get equal weight, regardless of the time consumption. If a problem takes more time than you allot, drop it and go on to the next. Others will take less time and it will be possible for you to go back.

Work those that seem simplest first and do one problem or each part of a problem on a single sheet of paper—this helps you save time if you skip around.

Solve as many problems as required. If you can't finish a problem, give as much of the solution as possible in the time allotment. So long as the method of solution is in the ball park you'll get credit for what you work. If time is running out set down the method step-by-step and carry through the numerical solution as far as you go.

A common complaint in exam "post mortems" is that the engineer just couldn't recall the simplest formula or the most familiar constant. He was prepared but couldn't respond. He ran into an "emotional block."

This is a common occurrence, so it's best not to worry about it. Just take a few commonsense precautions and relax.

- Don't try to finish your preparations the day before the test, nor stay up trying to cram.
- Take a mild form of physical exercise the day before.
- Go to bed early and get a full 8-9 hr. of sleep.
- Get to the examination room 20-30 min. ahead of time.

During the exam, should tension mount, take a break for a minute or two. Leave your desk and walk around as permitted. When you return reread the problem before you start to work it again or try another first.

But careful preparation that builds confidence in your ability to pass the exam is probably your best defense against the emotional block.

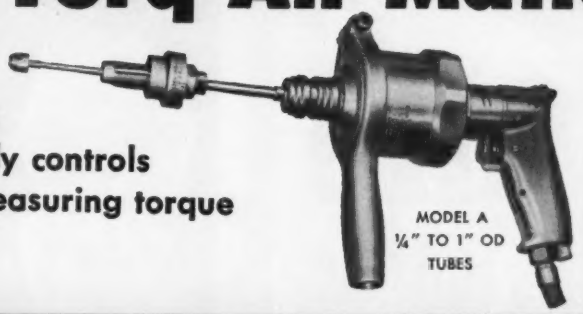
How State Examination Procedures Compare (continued)

In . . .	The Exam Is . . .	Run by . . .	Passing Grade is . . .	They Interview . . .	To Register As . . .
New Hampshire	4 hr. structural, 4 hr. basics, 4 hr. branch plus economics & ethics	Proctors	70%	Yes, except graduates of ECPD accredited schools	P.E.
New Jersey	4 hr. basics, 4 hr. structural, 5 hr. branch	Proctors	70%	No	P.E.
New Mexico	4 hr. basics, 4 hr. fundamentals, 4 hr. professional, 4 hr. problems	Proctors	70%	No	P.E.
New York	4 hr. structural, 4 hr. basics, 4 hr. branch plus economics & ethics	Proctors	75%	No	P.E.
North Carolina	8 hr. theory, 8 hr. branch	Proctors	70%	No	P.E.
North Dakota	4 hr. fundamentals, 4 hr. professional	Proctors	70%	No	P.E.
Ohio	⅓ day general closed book, ⅓ day basics open book, ⅓ day field closed book, ⅓ day branch open book	Proctors	70%	Yes	P.E.
Oklahoma	8 hr. fundamentals, 8 hr. branch	Proctors	70%	No	P.E.
Oregon	½ hr. oral, 13½ hr. written: 4 hr. fundamentals, 4½ hr. field, 5 hr. branch	Semi-proctored	70%	Yes	Branches
Pennsylvania	4 hr. fundamentals, 4 hr. professional	Proctors	70%	No	P.E.
Puerto Rico	4 hr. basic, 4 hr. fundamental, 8 hr. professional	Proctors	70%	No	P.E.
Rhode Island	3 hr. basic, 3 hr. branch	Proctors	70%	No	P.E.
South Carolina	7 hr. fundamentals, 4 hr. branch	Proctors	70%	No	P.E.
South Dakota	4 hr. theory fundamentals, 4 hr. basics, 8 hr. practice	Proctors	75%	Generally	P.E.
Tennessee	8 hr. general, 8 hr. field	———	——	Yes	Engineer
Texas	15 min. oral, 8 hr. fundamentals, 8 hr. professional plus an engineering report	Proctors	70%	No	P.E.
Utah	8 hr. fundamentals, 8 hr. branches	Proctors	70%	No	Branches
Vermont	3 hr. fundamentals, 3 hr. practice	———	60%	No	P.E.
Virginia	8 hr. fundamentals, 8 hr. branch, 1 hr. general, written report	Proctors	70%	Yes	P.E.
West Virginia	8 hr. fundamentals, 8 hr. professional	Proctors	70%	Yes	Branches
Wisconsin	8 hr. fundamentals, 8 hr. branch	Proctors	70%	No	P.E.
Wyoming	4 hr. fundamentals, 4 hr. practice	Proctors	70%	No	P.E.

This table was developed by the author from data supplied by the National Council of State Boards of Engineering Examiners for which the author expresses his thanks. Each board, of course, retains the right to change any of these conditions at any time, without notice.

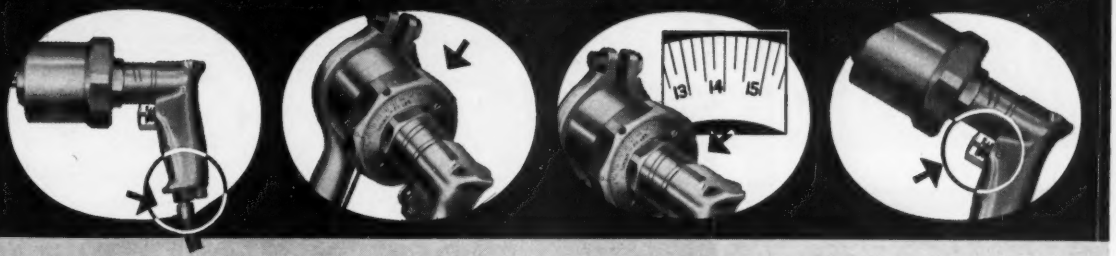
New WILSON Torq-Air-Matic

First and only air-driven tube expander drive that accurately controls tube expansion by directly measuring torque output at the mandrel.



MODEL A
¼" TO 1" OD
TUBES

Look at these exclusive design features of the WILSON Torq-Air-Matic

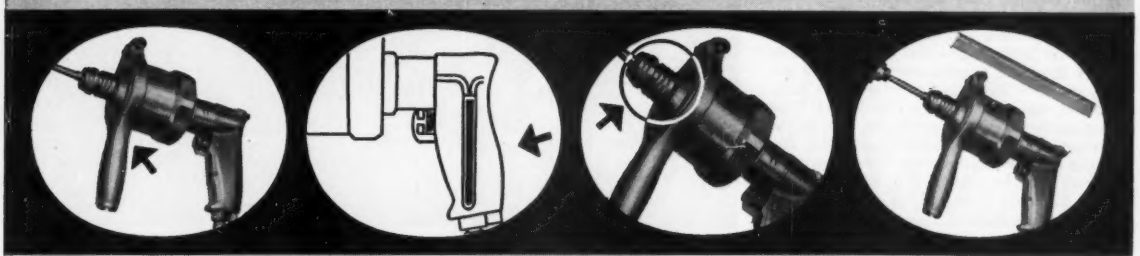


AIR-DRIVEN—Only air-driven tube expander drive with a built-in torque control. *Does not require a separate control box, relays or switches.* No extra cables or wires; just one small air hose serves it.

CALIBRATION—The only tube expander control calibrated *in terms of foot pounds torque instead of meaningless arbitrary units.* Torque requirements for expanding tubes of off-standard jobs can be more readily arrived at.

POWERFUL—Rated to deliver *fourteen foot pounds torque* at 90 psi. This is sufficient to roll 1" OD x 11 gauge boiler tubes.

SIMPLE—Only a *single three-position trigger throttle* for off, forward and reverse. Never any danger of over-rolling because of improper sequence of operation. No juggling of switches; nothing new to learn.



CONVENIENT—*Furnished with an auxiliary handle that can be swivelled to any position desired* by the operator or left off when the torque reaction is not too great. Basic unit is of a pistol grip design.

TROUBLE-FREE—*Has an oil reservoir* built into the handle to supply lubrication to the motor. *The control section is independent of the motor and lubricated for life.*

CHUCK—*Simple, new type, snap on floating chuck. Only one motion* instantly engages or disengages a square shank mandrel—no set screws.

COMPACT—Only 10" overall from pistol grip handle to instant action chuck.

TW 850

These features speak for themselves. The Wilson air-driven Torq-Air-Matic tube expander drive and control is an important revolutionary advance in the field of precise tube expanding. Here's what you get when you use the Wilson Torq-Air-Matic control for heat exchanger tubes: (1) uniform and tight pressure joints, regardless of tube sheet hole variation; (2) no over-rolled or under-rolled tubes—no stresses that shorten tube life; (3) extended tube expander life, more production, higher profits.

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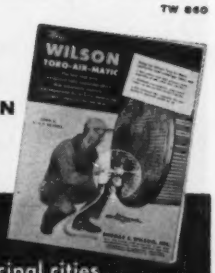

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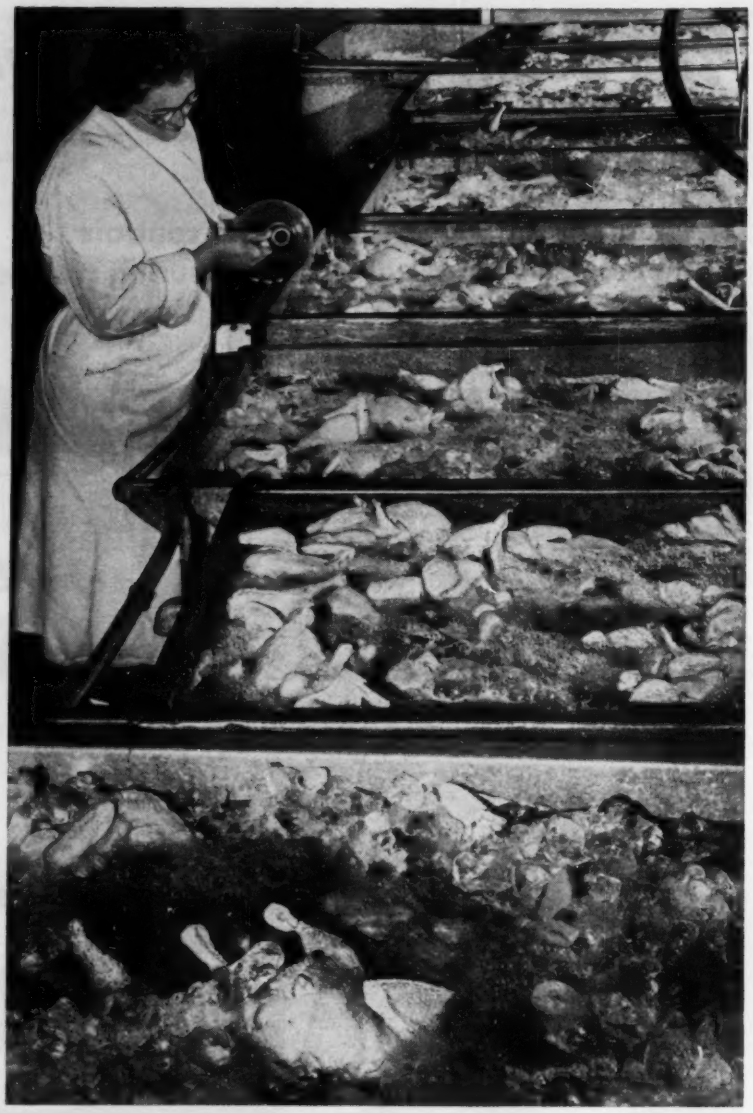
Life ...on the Chemical Newsfront



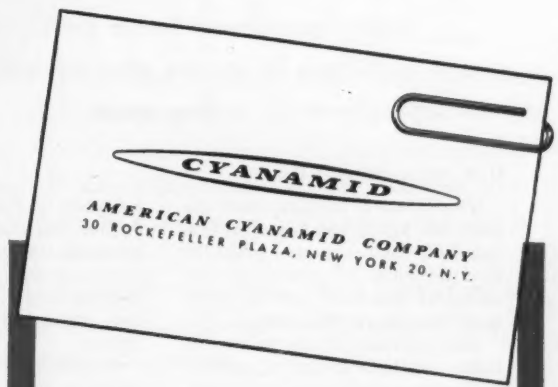
NEW PROCESS KEEPS FOOD FRESH LONGER. Years of research on the use of antibiotics to slow food spoilage now are paying off. In the photograph (right), a solution of ACRONIZE* chlortetracycline (based on a special food grade of AUREOMYCIN® chlortetracycline) is being added to chilling tanks in which processed chickens are cooled. Only 2.6 ounces in a 200-gallon tank slows growth of spoilage bacteria, lengthening poultry freshness several days. Test birds stored two and three times longer than the normal merchandising period under commercial refrigeration taste and look the same as fresh-killed fowl. Only trace amounts of the antibiotic are in the solution, and these diminish on aging, disappear entirely on cooking. This new process may soon be extended to fish and other meats to bring fresher food to your table. **(Fine Chemicals Division)** *Trade-mark

"FIRE-ENGINE RED" is the familiar name for Cyanamid toluidine toners, the pigments that produce brilliant, clean shades of red. Highly resistant to weathering, they are used extensively in finishes for fire-fighting equipment, hydrants, farm implements, gas pumps, signs and other metal or wood surfaces exposed outdoors all year long. Because of high hiding power, these pigments cover well and go a long way in paint formulations. Offered in light, dark or medium shades, they are easy to disperse in typical paint formulations. **(Pigments Division)**

A NEW CONCEPT IN INSECT CONTROL is embodied in THIMET® Systemic Insecticide. The first systemic that can be applied effectively to seeds, it is absorbed by the growing plants and kills insects that feed on them for periods up to 7 weeks. Results of a typical field test on cotton are shown above: unprotected plants on the left have been stunted by early season insect attack; plants on the right were treated with THIMET Systemic Insecticide. As a result of such tests, THIMET will be marketed on an experimental basis to cotton seed dealers in Texas and Mississippi for treatment of seeds for this year's crop. **(Agricultural Chemicals Division)**

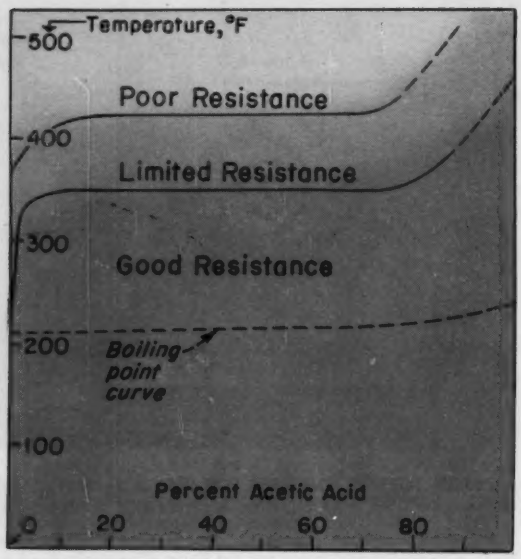
MODERN TORTURE CHAMBER FOR DYES is the family washing machine. High water temperatures, strong detergents, bleach and constant agitation soon separate color from fabric—unless dyes are truly fast. Best dyes chemistry has yet developed for cottons, washable rayons and linens are Vat Dyes. Chemically fixed in the fabric for its life, they take all the washing, exposure to sun, salt water, perspiration and rubbing the fabric itself can stand. Cyanamid Vat Dyes, of course, are only part of a full line of dyes used in textile, paper, leather, plastics and other products where color counts. **(Organic Chemicals Division)**

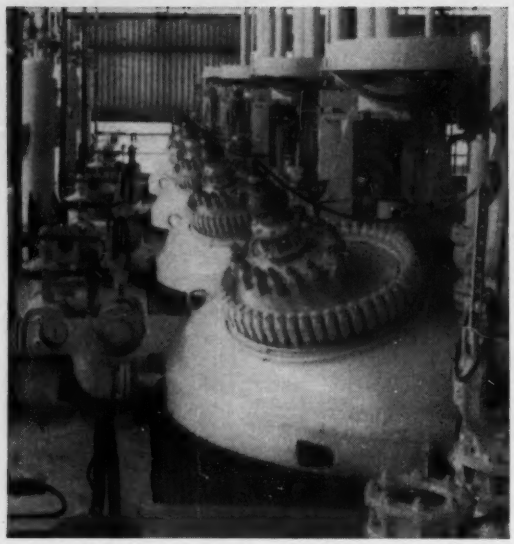
LET'S GO PROSPECTING IN A *MODERN* WAY. Our New Product Development Department does everything it can to help chemists prospect the commercial possibilities of new chemicals developed by our research laboratories. One such chemical is N,N'-METHYLENEBISACRYLAMIDE, a reactive, bi-functional monomer that undergoes reactions typical of activated double bonds or amide groups. It copolymerizes with other monomers in the presence of peroxide catalysts to yield cross-linked, insoluble resins. Another important property of N,N'-METHYLENEBISACRYLAMIDE is its ability to react with compounds containing active hydrogens. Similar applications of this monomer may lead to pay dirt in your particular field. If prospects look good to you, let us send you data and a sample. **(New Product Development Department, Section B)**



Building for the Future Through Chemistry

Additional information may be obtained regarding these products by writing on your business letterhead to the Division of American Cyanamid Company, 30 Rockefeller Plaza, New York 20, N.Y., indicated in the captions.





TEMPERATURE-CONCENTRATION plots show resistance of equipment lined with acid-alkali resistant glass.

High Temperature Acid Resistance of Glass

Latest data permit better decisions as to the potential usefulness of glassed steel equipment in contact with acids above the boiling point.

D. K. Priest, Pfaudler Co.

The chemical industry over the past few years has been increasing its temperature and pressure requirements to obtain certain chemical reactions or to carry them out more efficiently.

One problem which arises because of these extended operating conditions is that of the corrosion resistance of glassed steel vessels which are to be used at higher temperatures. This article includes the latest data on the corrosion resistance of glassed steel, and is intended to make clearer the potential usefulness of glassed steel at elevated temperatures. The data does not constitute finished and complete definition of the corrosion resistance of glass at elevated temperatures, because corrosion testing is a continuing process and it is intended that new data will be added in the future.

In addition to corrosion resistance data, some remarks are included on the mechanism of attack of glass by acids and water—which should be of help in guiding the user of glassed steel toward better decisions concerning its application.

DR. D. K. PRIEST *is head of corrosion research, Pfaudler Co., Rochester, N. Y.*

Test Procedure

Corrosion tests were carried out in high-pressure autoclave units, the autoclaves glassed with the type of glass under test. These are placed on a testing bench, heat is applied and tests carried out for 10, 15 or 30 days.

Because no quantitative method for evaluating corrosion resistance at high temperature has yet been devised, the tests are evaluated by visual inspection. Color photographs are taken of the unit after the tests are complete, and surface replicas made which are indicative of the degree of etching produced by a given test.

Results

A large amount of data was considered in making up the charts included with this article. Much of it is complicated and controversial, so that no attempt has been made to include actual data on the charts. Instead, general areas of interest have been indicated.

Three curves appear on each chart. The lowest curve is the boiling point curve showing the variation in boiling point as the acid concentration changes. Corrosion rates can be determined below the boiling point and such determinations indicate service

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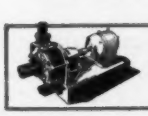
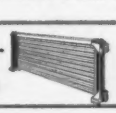


Pumps— Catalog Section S-7250

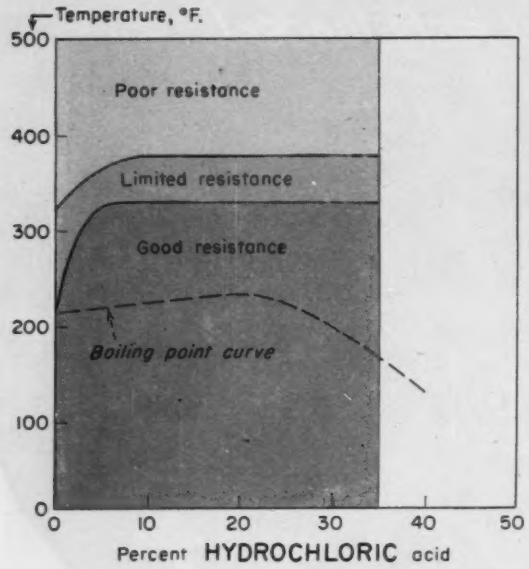
Pipe and Fittings— Catalog Section S-7000

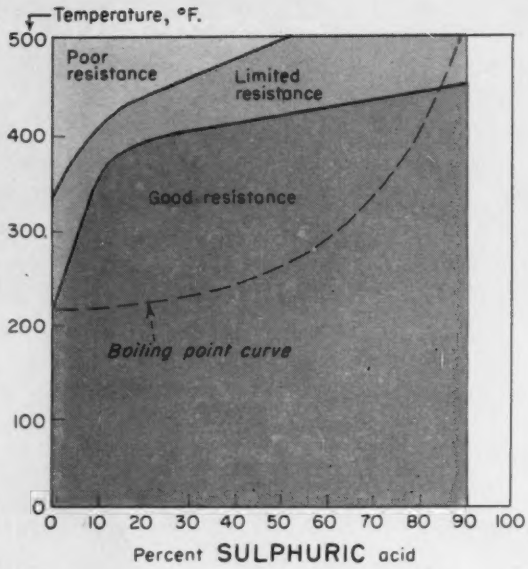
Heat Exchangers— Catalog Sections S-6740 and S-6840

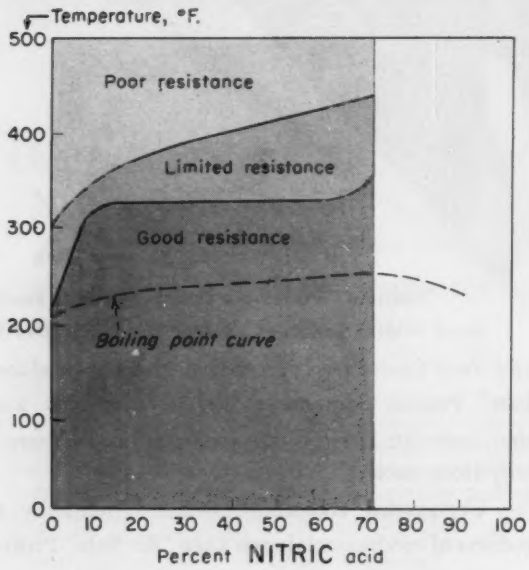


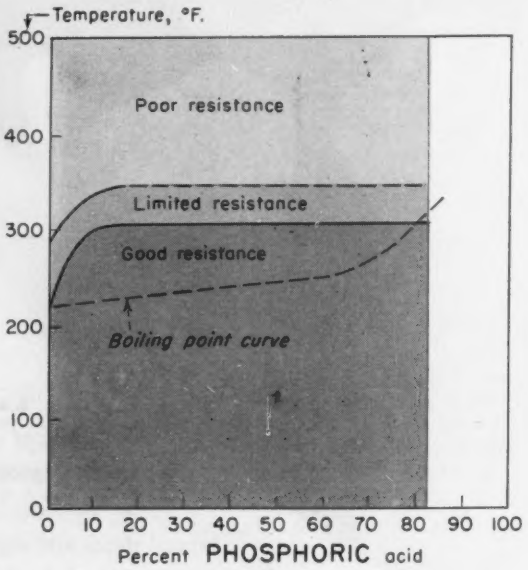
Cascade Coolers— Catalog Section S-6820

HCl Absorbers— Catalog Section S-7460









life for glassed steel to be in the range of ten to twenty years.

The two upper curves define three areas of interest. In the area below the center curve, glassed steel is considered to be adequate in resistance.

The area enclosed between the center and top curves includes all somewhat questionable or borderline applications. Here the severity of attack will be considered in relation to production cycles, thermal fluctuations, etc. — and a decision reached as feasibility of the particular application.

The area above the top curve represents applications which involve such a high rate of attack that glassed steel is not a practical material of construction. Such applications can be ruled out immediately unless some special circumstance warrants further investigation.

Presentation of data has deliberately been made rather general because the borderline applications of glassed steel are not subject to rigid rules. In the borderline region for example, the use of glass might be a practical necessity—even though its resistance were poor—because of the lack of any other resistant material of construction.

Inspection of any of the data charts reveals that at very low acid concentrations, temperature limitations are significantly lower than in higher acid concen-

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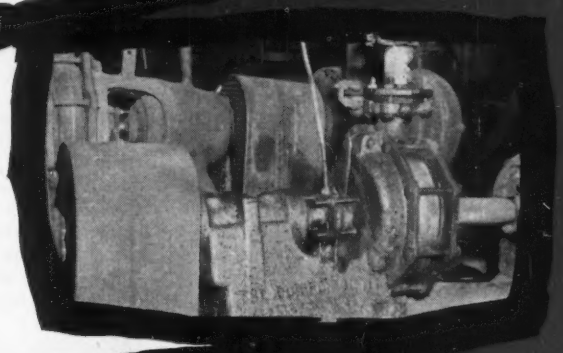

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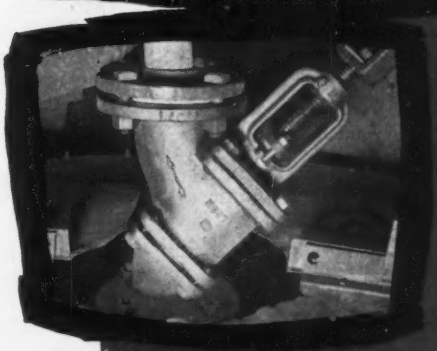
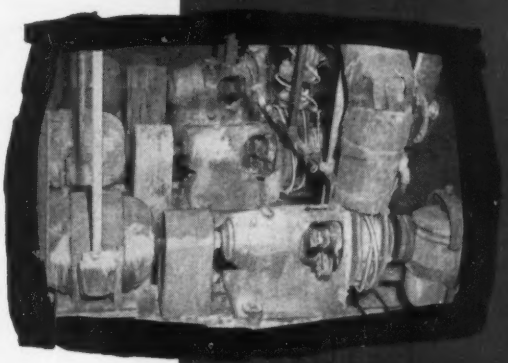
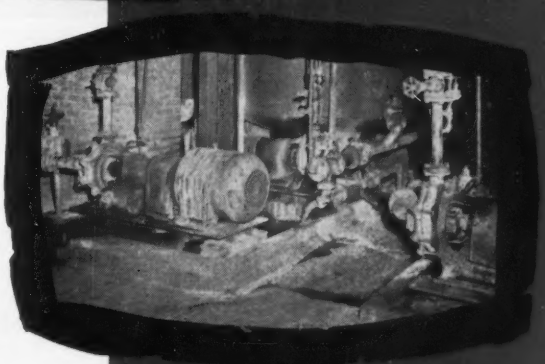


- ... transferring slurries of acid and direct dyes ...
- ... sulfonation of organic compounds with 25% Oleum ...
- ... concentrated solution of mixed sodium and potassium hydroxides at temperatures in excess of 100° C. ...
- ... handling a solution of benzoyl, benzoic acid in benzine saturated with aluminum chloride solution ...
- ... transferring alkaline solutions and saturated aluminum chloride in water solutions.



For detailed information about these Durcopumps, Durco valves, and other DURCO corrosion resisting products, contact your DURCO representative or write.



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trations. Nature of the attack at these low acid concentrations is a vapor-phase etching of the glass. As zero percent acid is approached, this attack becomes greater and greater.

Attack of glass by distilled water is the most severe type of attack. So in this sense, addition of acid to distilled water to make an acid solution inhibits the water vapor phase attack. This action increases the corrosion resistance up to perhaps 10% or 20% acid concentration.

With these general remarks in mind, a discussion of the corrosion attack of each kind of acid follows.

Acetic Acid

Corrosion resistance of glass to glacial acetic acid appears to be excellent at any temperature investigated to date. Glass suffers no attack under these conditions up to 450 F. In the middle concentration range (20-80% acetic acid), high temperature corrosion is most noticeable in the liquid phase. The vapor phase remains relatively unaffected. From 0-30%, acid attack seems to occur primarily in the vapor phase due to the effects of high-temperature water vapor. The transition from a vapor-phase attack to a liquid-phase attack seems to occur in the general range of 20-30% acetic acid.

Hydrochloric Acid

Because of an unusually large number of data, the chart concerning hydrochloric acid has perhaps the best definition. The borderline region is rather narrow, indicating the important influence temperature has on the corrosive attack. High temperature corrosion by hydrochloric acid is characterized by an intense attack of the vapor phase at all concentrations of the acid. The liquid phase is attacked also, but to a somewhat lesser degree. At very low acid concentrations, a water-vapor attack is encountered in the vapor phase also.

Nitric Acid

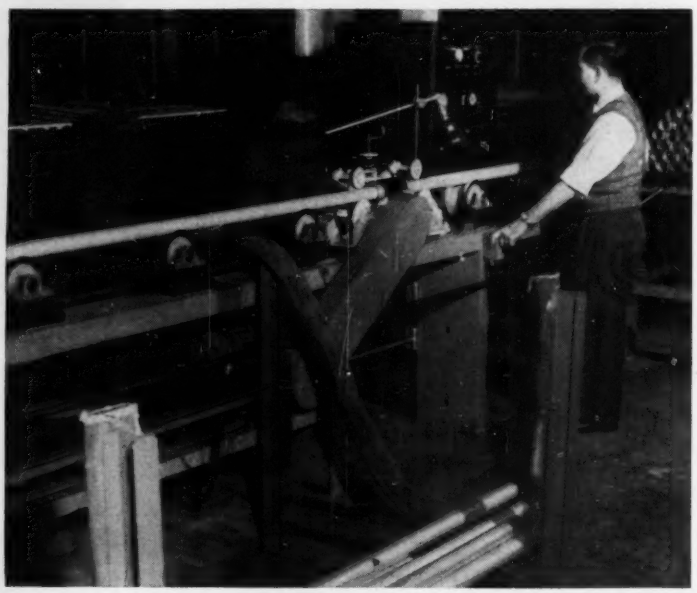
High-temperature attack of glassed steel by concentrated solutions of nitric acid occurs primarily in the liquid phase. In the approximate range of 20-60% nitric acid, attack is about equal in the liquid and vapor phases. Below about 10% nitric acid, vapor-phase corrosion becomes a serious factor at elevated temperatures.

Phosphoric Acid

Corrosivity of phosphoric acid toward glass is high. Consequently lower temperature limitations must be made. The usual corrosion pattern is repeated with vapor-phase attack being dominant at low concentrations (0-30% acid), both liquid and vapor-phase attack in the median concentrations (20-60% acid), and liquid-phase attack most important at high concentrations. Concentrated phosphoric acid (85%) does little corrosion damage to glass until it reaches its relatively high boiling point of 325 F. Crystalline phosphoric acid severely damages glass at 300 F. The liquid-phase attack of phosphoric acid is particularly severe in confined spaces such as beneath gaskets.

Sulfuric Acid

As is usual in aqueous solutions of acids, low concentrations of sulfuric acid allow water-vapor attack of glassed steel in the vapor phase. At concentrations of 30-50% acid and greater, however, practically no corrosion of glass occurs in either the liquid or vapor phase at temperatures up to 450 F. Strong, hot sulfuric does not appear to attack glass directly as do the other more common acids. With hot concentrated sulfuric acid, glassed steel equipment limitations are more likely to be due to thermal shock or mechanical failures, not glass corrosion.

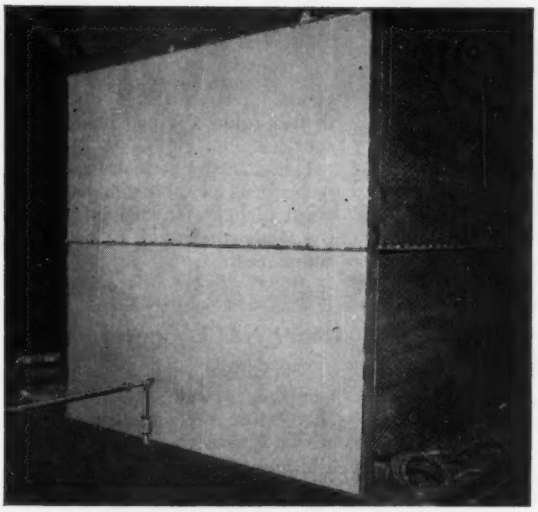


New non-destructive test equipment

For Better Quality Stainless Tubing

A new electrically-energized instrument for the non-destructive testing of austenitic stainless steel tubing has been added to the production facilities of The Carpenter Steel Co.'s Alloy Tube Division, Union, N. J.

The new equipment, first of its kind installed in a tube mill, is said to give closer and more



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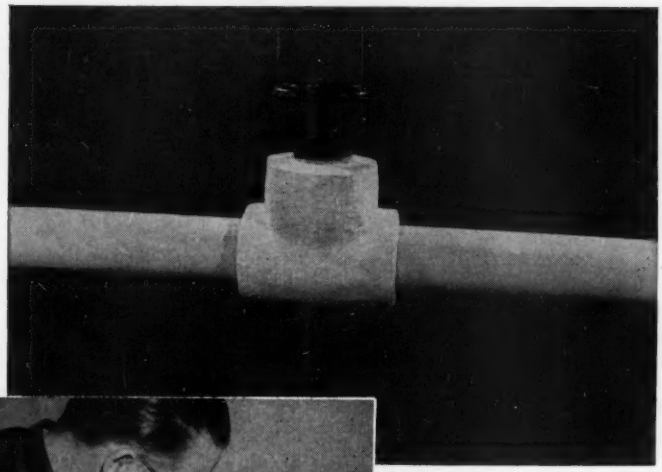

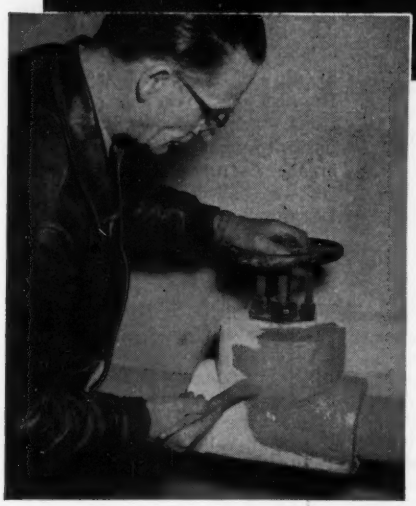

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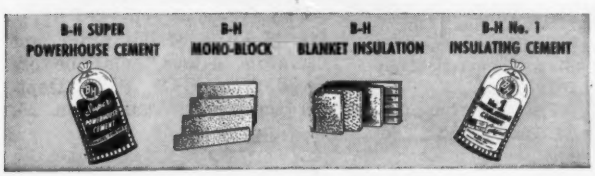
Where adjacent pipe covering is painted, B-H Super Powerhouse Cement readily takes application of either water-base or oil-base paints.

Made from the NEW Baldwin-Hill Spun Mineral Wool fibers, Super Powerhouse Cement dries out *white* to give you a better, more pleasing finish coat. And remember, it requires only one-coat application because it *insulates* as it *finishes*.



BALDWIN-HILL
COMPANY
1502 Breunig Ave. Trenton 2, N. J.
Kalamazoo, Mich. Huntington, Ind. Temple, Texas

critical quality control than ever before possible. Its adaptation follows nearly two years of joint research and development by Carpenter and Magnetic Analysis Corp., Long Island City, N. Y.

The unit inspects the inside and outside diameter surfaces of tubing along the full length and around the entire periphery. It also tests the complete wall thickness or sub-surface of material with walls up to 0.070 in. Under certain conditions it will inspect the entire internal structure of even heavier wall tubing.

No other commercial test method, Carpenter reports, is capable of detecting defects such as those found by this new device at production speeds.

Inspection by this improved method surpases test standards specified by the American Society of Testing Materials. The difference is that the new instrument inspects every inch of the tube length non-destructively, while by current industry procedure random destructive tests are performed only on certain sections.

In testing tubing by the lot, the machine detects any variation in chemistry, wall thickness, outside diameter and inside diameter. If, for example, the unit is set up to inspect Type 304 tubing, it will automatically reject Type 316 or any other type submitted for inspection—even though they are identical in size, gauge and overall appearance. This gives 100% verification of chemistry.

The equipment, with its ability to pick up variations in wall thickness and diameters, gives greater assurance that all tubing inspected by this method has a consistent wall thickness exactly as specified on an order.

At the present time, the unit tests full-finished, non-magnetic types of stainless steel including Types 304, 304L, 316, 316L, 321, 309, 310, 330, 347, 317, 317L, Carpenter No. 20-Cb and titanium. All material is inspected at production speeds.

As it is now set up, the equipment is capable of inspecting tubing with outside diameters ranging from 1¼-in. to 3½-in. Research is continuing to expand the size range and the extent of wall penetration in thicker tubing. Carpenter said it hopes to test all of its tubing and pipe non-destructively in the very near future.

This new quality control measure reveals minute defects invisible to the eye and even those that connot be disclosed by hydrostatic test. It will detect such critical flaws as carburization on the I. D. of a tube, weepers, mechanical defects caused by abusive handling, notches, I. D. gouges and imperfections in the parent metal.

Non-magnetic stainless grades having a permeability of 1.05 are easily inspected by the device. It functions at a high degree of efficiency so long as the magnetic permeability does not vary between the values of 1 and approximately 1.6 within a space of 2″ to 4″ along the length of a tube.

Sensitivity control makes possible adjusting the instrument to indicate defects of a pre-determined magnitude. Duplicate dial settings can be used to speed and simplify testing of repeat orders.

Audio-visual signals warn the operator the very instant a defect passes through the testing coil. Test results are continuously visible on an oscilloscope as a tube passes through the detector device.

Carpenter is now using the new device to test tubing of less than ¼ in. outside diameter which, because of its small size, has always been hard to inspect visually. It is also being used to test other tubing for critical services.

Non-destructive testing will be performed on tubing at user request in lieu of hydrostatic testing, Carpenter said, at no additional cost.

NEXT MONTH:
BEST LEAD DESIGNS

See next month's Corrosion Forum for Part I of Best Designs for Lead Installations. The series is based on a report just completed by the engineering division of The Consolidated Mining and Smelting Co., Trail, B. C. It will assist both design and maintenance engineers in plants using lead as a material of construction, by showing them how to overcome common failures due to faulty installations. Cominco's long experience as a user of lead makes this series particularly worthwhile.

1959 NACE Conference

The 1959 Fifteenth Annual Conference and Exhibition of the National Association of Corrosion Engineers will be held in Chicago. Sherman Hotel will be headquarters for the technical sessions and exhibition.

The 1956 meeting will be in New York at Hotel Statler; 1957 in St. Louis and 1958 in San Fransisco.

New Info on Titanium Scaling

An evaluation of relative scaling tendencies of experimentally and commercially produced titanium and titanium alloys is contained in a recent report.

Forty-three titanium-base alloys, one commercial grade of titanium, and Type 302 stainless steel were scaled at 1,200, 1,400, 1,600, and 1,800 F. from 4 to 300 hr. Two additional alloys were used at 1,200 and 1,600 F.

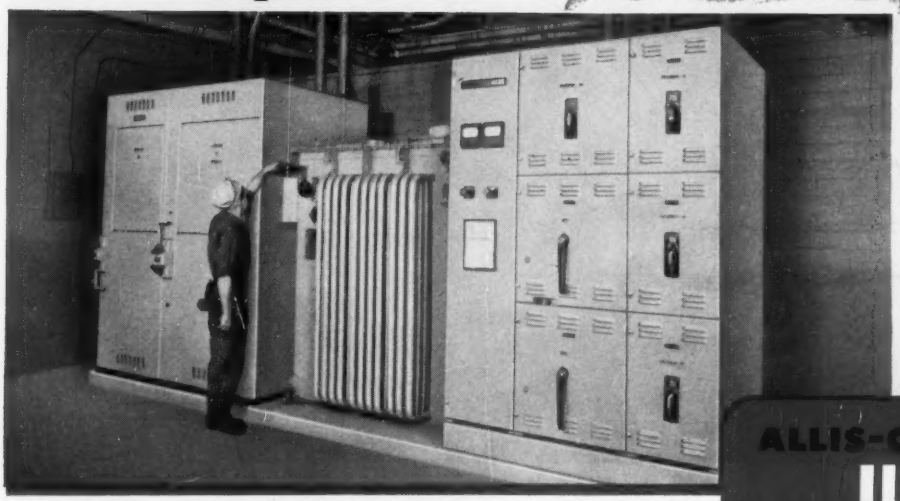
The alloying elements Cu, Al, Si, V, Cb, Ta, Cr, Mo, W, Mn, Fe, and Ni, in various combinations, added to commercially pure arc-melted titanium can increase, decrease, or have no effect on scaling resistance of the titanium. In certain instances, 0.5% to 8% of alloying elements produces radical changes in the scaling resistance of the titanium.

On being exposed to progressively higher temperatures within the range 1,200 to 1,800 F., experimentally produced binary and ternary titanium alloys generally became increasingly superior to titanium. Commercially produced alloys became increasingly inferior.

The 137-page report, PB111-731 "Scaling of Titanium and Titanium Alloys," may be ordered from OTS, U. S. Dept. of Commerce, Washington 25, D. C., price $3.50.

Turn Hidden Losses Into Profit

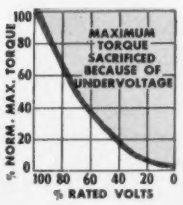
Modernize Your Plant's Electrical System

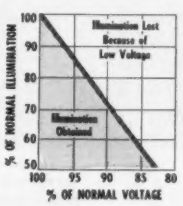


Flexible, compact units fit into any plant. Allis-Chalmers unit substations can be mounted anywhere. Tuck them into a corner of the production floor, mount them on balconies, in the basement, on the roof, or outside the building. Metal enclosures eliminate need for vaults and provide attractive appearance.

ALLIS-CHALMERS

UNIT SUBSTATION





Charts Show Losses when voltage is low. Upper, torque loss at machines. Lower, illumination lost. Placing unit substations at load centers shortens low voltage cable, improves voltage, and makes future changes simpler, less costly than with many outmoded plant arrangements.

Outmoded or inadequate plant electrical systems steal profits. When voltages are low you lose in machine and operator efficiency. Dim lighting cuts inspection and assembly efficiency. Addition of new machinery to plants with older systems frequently causes extra expense for long secondary wiring.

Solve the problem with modern Allis-Chalmers unit substations. Full power is distributed from the center of load. Voltage drop and conductor losses are kept to a minimum. Expensive secondary wires to equipment are short and flexible — it is easy to make changes at little expense.

Let experienced substation engineers help solve your distribution problem. Call your nearby Allis-Chalmers district office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for your copy of "Power at Load Centers Pays Off."

ALLIS-CHALMERS

A-4740

Exploring the operating advantages of Goulds Fig. 3715 chemical pump.

Take this pump apart right in your office . . . and you'll see how it can *save* you *money*

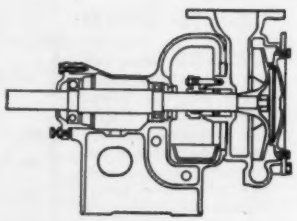
You'll find new features in the Goulds Fig. 3715 chemical pump.

They're features that make it a rugged, dependable, long-lived pump for handling corrosive liquids. And you can check them yourself without moving away from your desk.

We've built an aluminum model of the Fig. 3715 pump — complete in every detail. Ask your Goulds representative to show it to you.

You can open it up, take it apart, and see in detail such features as the easy method for adjusting impeller clearance—the chamber for cooling the support head so that you can operate the pump up to 350° F.—the design that permits you to inspect and clean the inside of the pump without disturbing the piping.

Call your Goulds representative today. Tell him you'd like to examine the Fig. 3715 model and he will gladly set a date at your convenience. Or write us in Seneca Falls and we'll make the arrangements promptly.



CROSS SECTION of Fig. 3715 pump.

You can get the Goulds Fig. 3715 pump in an alloy to meet your liquid handling requirements, including 316 and Gould-A-Loy 20 stainless steels, all iron, all bronze, bronze-fitted,—iron with stainless trim, or bronze with stainless trim. And it's available in 9 sizes providing capacities up to 720 GPM, and heads up to 200 ft. For additional details write for Bulletin 725.4.

MEMBER

Goulds PUMPS INC. Seneca Falls New York

Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburg • Tulsa

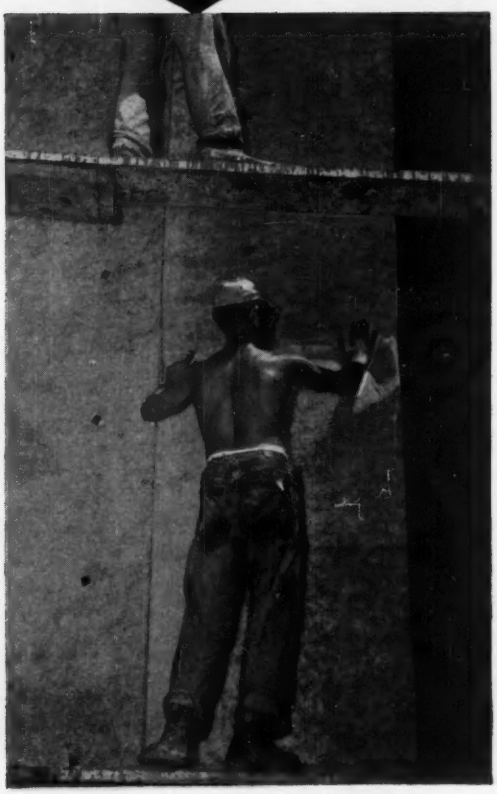
SOME RUN IT UP AND DOWN

SOME RUN IT ROUND AND ROUND...

VERSATILE

ULTRALITE

TANK INSULATION



Techniques of applying Ultralite vary, but everyone agrees that it is by far the fastest and cheapest way to insulate tanks, vats, vessels and other heated equipment.

With blanket rolls up to 10 feet wide, in no time at all you can cover any regular or irregular shaped vessel with this flexible glass fiber insulation. What's more, the vessel will be insulated "once and for all" — for Ultralite is a permanent insulation.

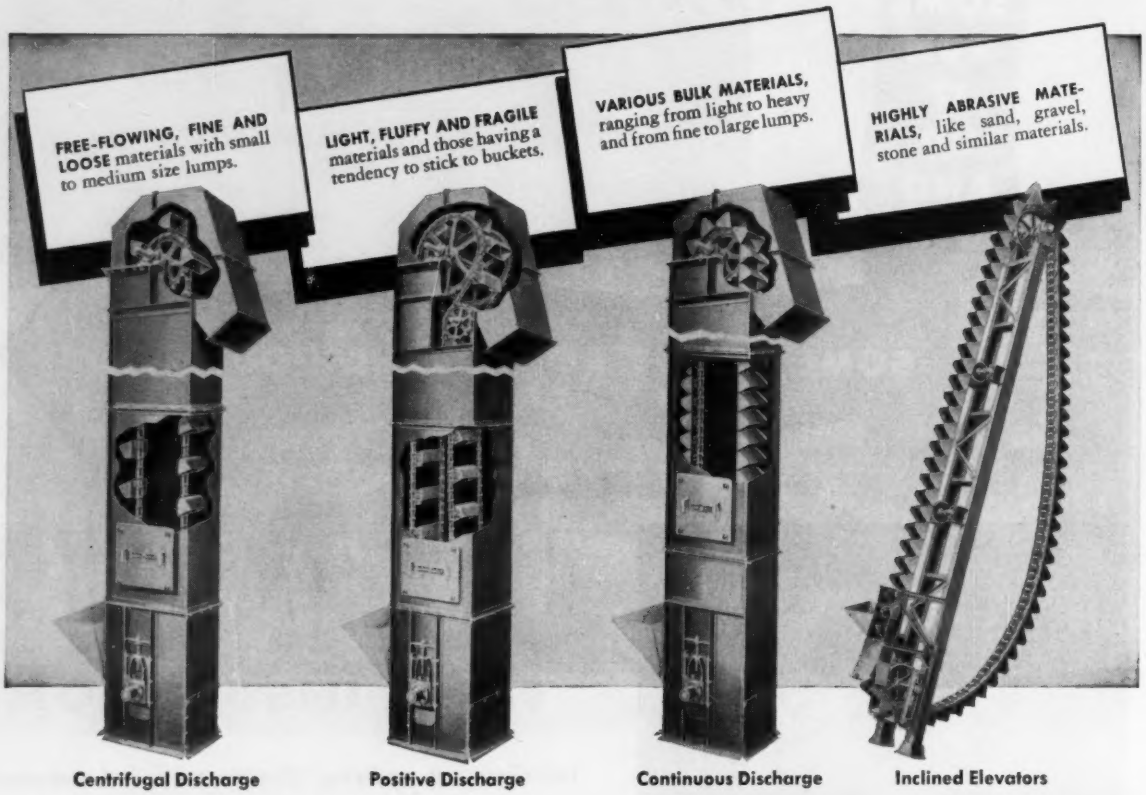
When you consider that labor is by far the big item in insulating, it makes sense to select the insulating material that lends itself to the fastest, easiest application. That material is Ultralite, the only insulation of long textile-type glass fibers. Write today for samples, prices, specifications and suggested application methods.

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe coverings and fittings • Molded glass fiber pipe insulation

252 W. 10TH ST., KANSAS CITY, MO.

LINK-BELT Bucket Elevators are tailored to suit your needs


FREE-FLOWING, FINE AND LOOSE materials with small to medium size lumps.
LIGHT, FLUFFY AND FRAGILE materials and those having a tendency to stick to buckets.
VARIOUS BULK MATERIALS, ranging from light to heavy and from fine to large lumps.
HIGHLY ABRASIVE MATERIALS, like sand, gravel, stone and similar materials.
Centrifugal Discharge
Positive Discharge
Continuous Discharge
Inclined Elevators

What kind of materials must you elevate?

SELECTING the right elevator to handle your material is no cut-and-dried procedure, but it's easy when you depend on Link-Belt. For top efficiency, a number of needs must be considered: the right buckets, correct bucket spacing for clean pickup and discharge, the right takeup, and a correctly designed hood that prevents back-legging. Link-Belt's broad line of 13 elevator types in four basic designs—plus a wide selection of quality malleable iron, Promal, or steel buckets—assures the right elevator leg to suit your operations exactly.

This specialization also explains why it pays to call in Link-Belt when designing a new plant, so that all elevating requirements can be satisfied from the outset. Equally important, Link-Belt offers lowest-cost installation, operating and maintenance . . . stemming from advanced design.

Whether you handle large or small quantities, get the advice of a Link-Belt materials handling expert. Call the Link-Belt office nearest you.

Twin Link-Belt continuous discharge bucket elevators provide continuous flow of materials at this cement mill. Frames are of structural steel, and casings can be provided when desired.

LINK-BELT

BUCKET ELEVATORS

13,707

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

YOU SAVE 3-WAYS

with Glascote glass-lined pipe and fittings

Ultimate in corrosion resistance... zero contamination with leak-proof joints... lower costs thru longer service life

Glascote glass-lined pipe and fittings are the solution for moving acids or alkali and other corrosive materials. Made with the same precision and quality control used on other Glascote products. Glass linings are applied in successive applications and thoroughly inspected and tested for trouble-free operation. Glascote pipe is highly effective in use with any materials normally processed in glass-lined containers.

Leak-proof gaskets are available to suit materials conveyed in the pipe. What's more installation can be made without special tools. Maintenance can be performed by your own personnel.

Glascote produces and maintains a stock of glass-lined pipe in 10-foot lengths and fittings ranging in inside diameters from 1½ to 4 inches. (6-, 8-inch and larger sizes are fabricated to order.)

Efficient, corrosion-resistant Heat Exchangers may be assembled from lengths of jacketed pipe. The use of either elbows or return bends provides a versatile operating assembly.

Glascote®

PRODUCTS, INC.

CLEVELAND 17, OHIO

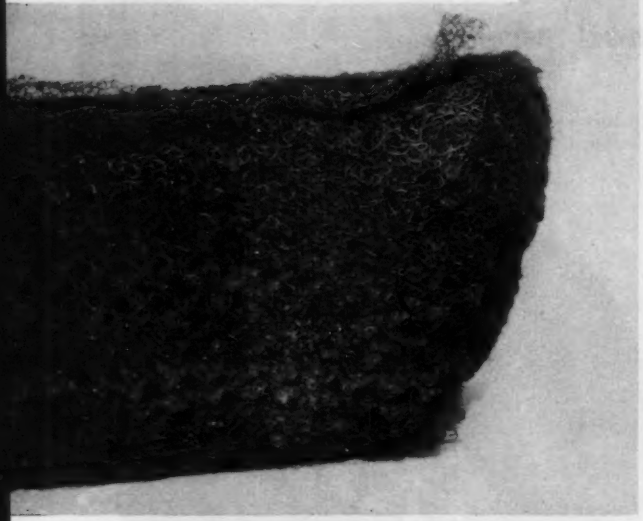
Sales offices or agents in Principal Cities

Export Sales:
A. O. Smith Corp., International Division, Milwaukee 1, Wisconsin

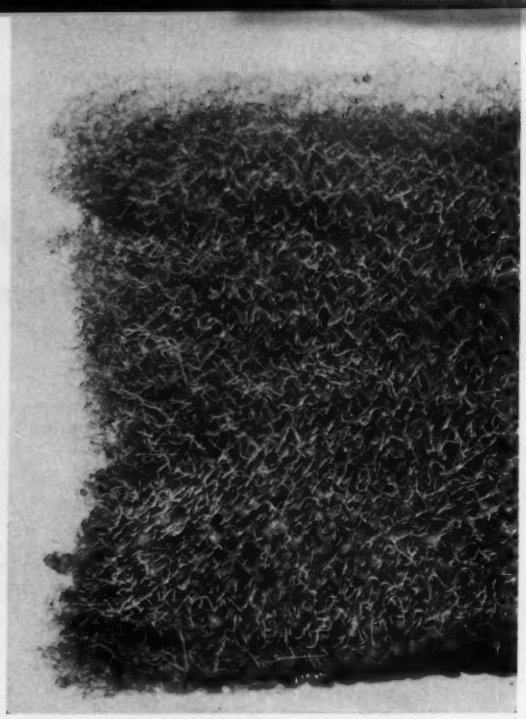
Ask the representative who calls on you for all the facts about Glascote products — reactors, receivers, condensers, evaporators, storage tanks and accessory products. Or, if you prefer, write direct. Glascote Products, Inc., Cleveland 17, a subsidiary of A. O. Smith Corporation.

A subsidiary of A.O.Smith Corporation

World's largest manufacturer of glass-lined steel products



Out of a coking problem . . .



A new mist eliminator to . . .

Remove Liquid Entrainment Better

Three-fold gain in high-temperature service life boasted for new entrainment separator. Good removal, low pressure drop and low cost.

There's a new "twist" in entrainment separation. Literally, by twisting the structure of its knitted-wire mist eliminator in a different fashion, Metal Textile Corp. has licked a tough operating problem. But more important, the new separator is a better all-round performer than its predecessor.

▶ **How It Happened**—In refinery operation, entrainment separators are vital in high-temperature vacuum flashers. They stop liquid carry-over which causes catalyst poisoning in downstream equipment and poor color in the overhead. At the high temperature, coke may build up in the separator mesh to cause increased pressure drop and frequent shutdown.

Faced with this problem at one of the nation's largest refineries, Metal Textile revamped construction of its mist eliminator to reduce coking rate and thereby extend service life three fold. Comparable gain is reported for other applications where solids are part of the entrainment, or are created by operating conditions.

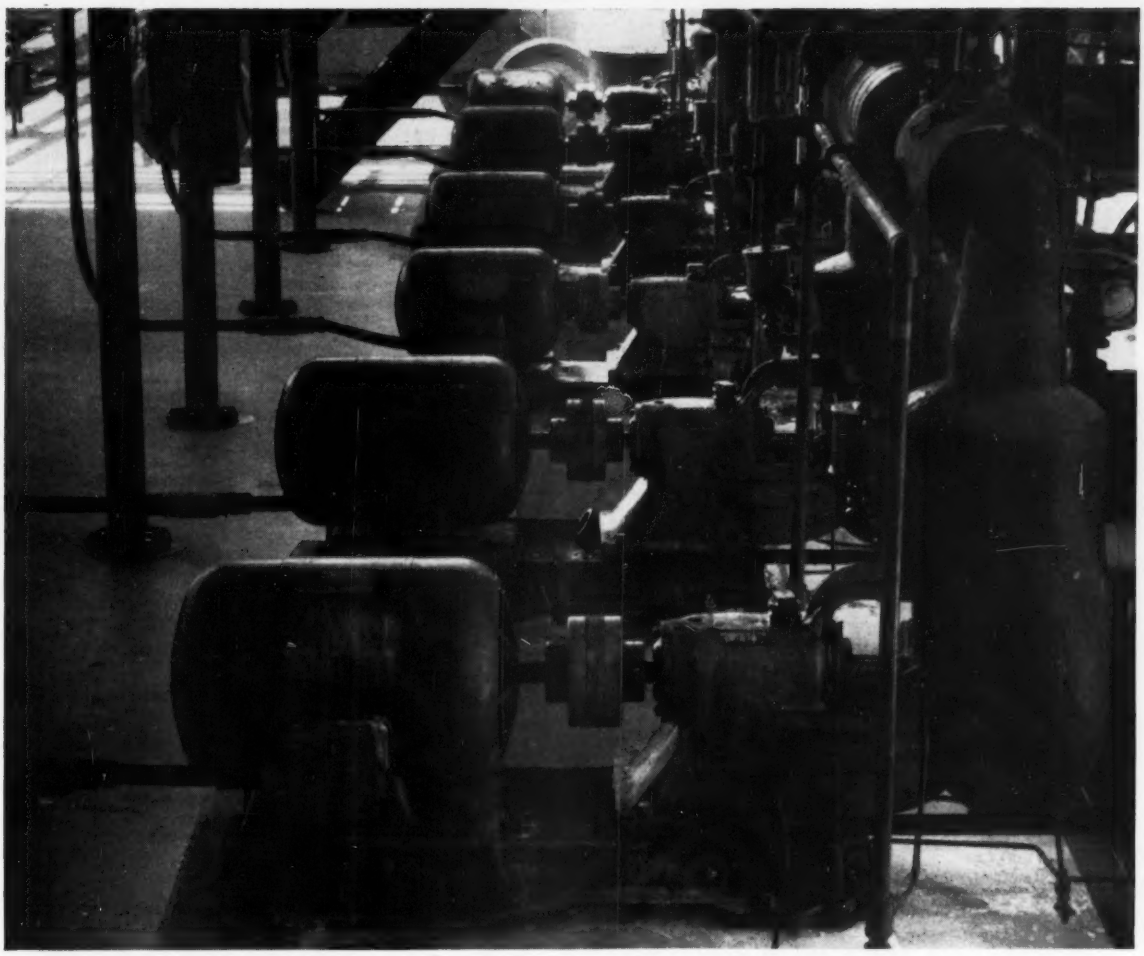
On installations where entrainment is completely liquid and does not solidify, the new Metex Hi-Thruput Herringboned mist eliminator has one-half the pressure drop of its predecessor and works with equal effectiveness at velocities 10 to 15% higher. Best of all it costs less per square foot than the older type.

▶ **Entrapped in Mesh**—When an entrainment-laden gas stream passes through the knit-wire Metex separator, liquid droplets impinge on the wires. As the droplets hang on the wires, they coalesce into larger drops of sufficient size to run down through the mesh to the bottom surface. There, they break away from the wires and fall back through the rising gas stream.

The mist eliminator is a uniform pad of knitted wire mesh. Each layer is crimped diagonally and the direction of crimp is alternated in successive layers.

▶ **What's Different** — How a Metex separator is constructed and operates is generally the same for either the Standard or new Hi-Thruput Herringboned units. But the Hi-Thruput construction incorporates two basic changes: The size and contour of the openings in the knitted mesh itself are modified and the wires in each layer of mesh have been repositioned by the patented Herringbone Fold process.

Performance statistics based on results of actual installations in processing plants show that these changes have resulted in three basic improvements. Although less wire is actually used per cubic foot, modification of the size and contour of openings in the knit provides an increased amount of free and usable wire surface for impingement. No longer is an ap-



The Answer To a Tough Problem — They Bought **LaBours**

Handling resins and fatty acids at temperatures up to 520°F calls for pumps with real ability to stand up under punishment. That's why this picture from the Bay Minette, Alabama, plant of Newport Industries, Inc., shows six LaBour pumps.

These pumps have steam jacketed heads and water cooled seals and bearing brackets. The great advantage of having LaBours: you know they can be depended on for long trouble-free service. As this is written these pumps have been on the job nearly two years.

Cost-conscious buyers know the real measure of pump economy is not the original price, but the service rendered per dollar of total cost for the life of the equipment. Because LaBour pumps minimize down-time and repair expense they welcome this realistic comparison. We'll be glad to supply some interesting facts at your request.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.

Newsworthy Equipment This Month

Equipment Cost Indexes, p. 232

New Processing Equipment
- Entrainment Separator 230A
- Filter Cover 232A
- Leaf Filter 234A
- Backwasher 236A
- Pilot Reactors 236B
- Pressure Filter 236C

New Instruments & Controls
- Infrared Analyzer 238A
- Infrared Analyzer 238B
- Valve Actuator 238C
- Sight Flow Indicator 238D
- Flow Integrator 238E
- Temperature Transmitter 238F

New Fluids Handling Equipment
- Gage Snubber 240A
- PVC Pipe 240B
- Ball Valve 240C
- Air Cleaner 240D
- Orifice Plate 240E
- Plastic Pipe 240F
- Slurry Pump 242A
- Armored Glass Pipe 242B
- Diaphragm Valve 242C
- Controlled Pump 242D
- Regulator-Shutoff 242E

New Electrical & Mechanical Equipment
- Metal Cutting Process 244A
- Chain Couplings 244B
- Magnetic Separator 244C
- Equipment Movers 244D
- Keyway Replacement 244E

New Maintenance Tools & Supplies
- Safety Harness 246A
- Resistant Gasket 246B
- Extension Lubricator 246C
- Pipe Cleaner 246D

Page number is also Reader Service code number

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preciable percentage of the wire surface area blocked out of service by being compressed against other wires in the same layer.

Further, the number and diversified location of impingement targets has been increased by repositioning the wires.

These two essential features, achieved by the patented Herringbone Fold process, have been gained without any increased restriction. Rather, the pressure drop is halved.

▶ **Droplet Sizes**—In general, entrainment removal is most efficient when a high percentage of the droplets are 5 microns or larger. If all particles are small, removal efficiency may not be as great as when small particles are mixed with larger ones.

When the liquid entrainment is a fog of submicron particles, it can be removed from the gas stream using a two stage separator. First stage is another newly developed media knit in dense form to increase collisions between particles. Glass fibers and metal wire are knit together in parallel. The fog coalesces on the glass which is held in the correct position by the stiffer wire.

In turn, this separator is followed by a larger-diameter, lower-velocity mist eliminator which removes the larger coalesced particles. This two-stage fog entrainment separator provides efficient removal on a high velocity stream.

While entrainment problems involving submicron particles may require special media, Metal Textile expects to handle a major portion of entrainment problems most effectively, with greater economy and longer on-stream life than ever before, using the new Hi-Thruput Herringboned mist eliminator. — **Metal Textile Corp., Roselle, N. J.** **230A**

Filter Cover

Operates rapidly and easily.

Now standard equipment on all Model MCR retractable-tank vertical-plate filters is the new Passalaqua speed-lock cover. This easy-to-operate safety cover is approved by ASME. It has proven particularly useful for pressure vessels that require frequent opening.

Cover is locked by a series of visible bow-shaped lugs mounted on a third ring. This ring floats in roller bearings. When internal tank pressure builds up, lugs on the ring are under shear pressure. An O-ring sealing gasket becomes tighter in direct proportion to the increase in internal pressure.— **Sparkler Mfg. Co., Dept. P, Mundelein, Ill.** **232A**

Equipment Cost Indexes

	June 1955	Sept. 1955
Industry		
Avg. of all.....	188.1	191.0
Process Industries		
Cement mfg.	180.2	182.8
Chemical	189.0	191.3
Clay products.....	175.0	177.6
Glass mfg.	178.6	181.2
Paint mfg.	181.9	184.6
Paper mfg.	182.2	184.9
Petroleum ind.	185.6	188.3
Rubber ind.	188.0	190.8
Process ind. avg..	186.1	188.9
Related Industries		
Elec. power equip...	190.8	193.6
Mining, milling	189.9	193.0
Refrigerating	208.7	211.8
Steam power	178.1	180.7

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See *Chem. Eng.*, Nov. 1947, pp. 124-6 for method of obtaining index numbers; March 1955, pp. 178-9 for annual averages since 1913.

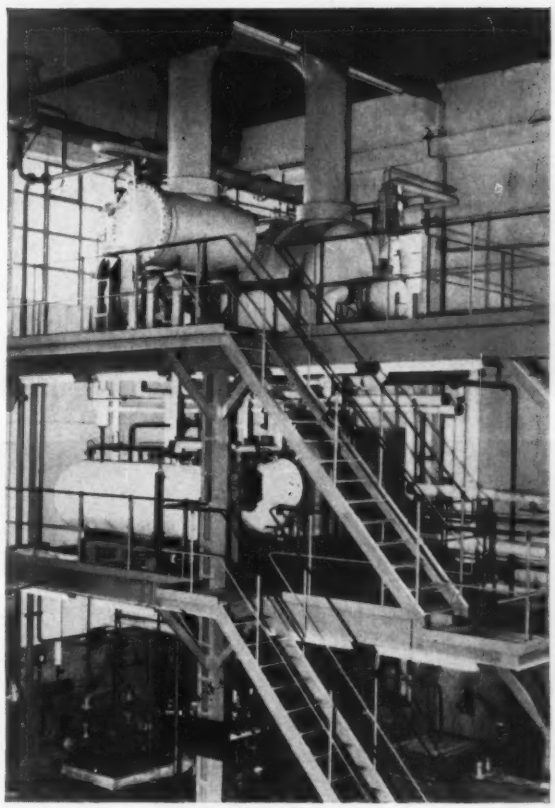
IN MONTEVIDEO...

another FW plant for low-cost distillation of

fatty acid

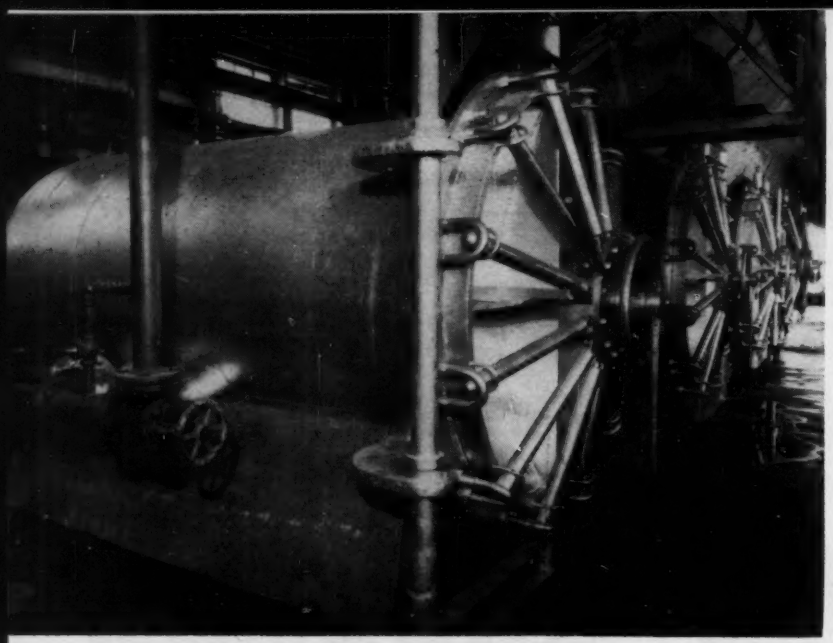
NEWEST ADDITION to the World Roundup of FW fatty acid processing units—the distillation plant shown here was built for Compania BAO, Montevideo, Uruguay. Designed and engineered by Foster Wheeler, this plant has a rated capacity of 1500 lb per hour of crude fatty acid.

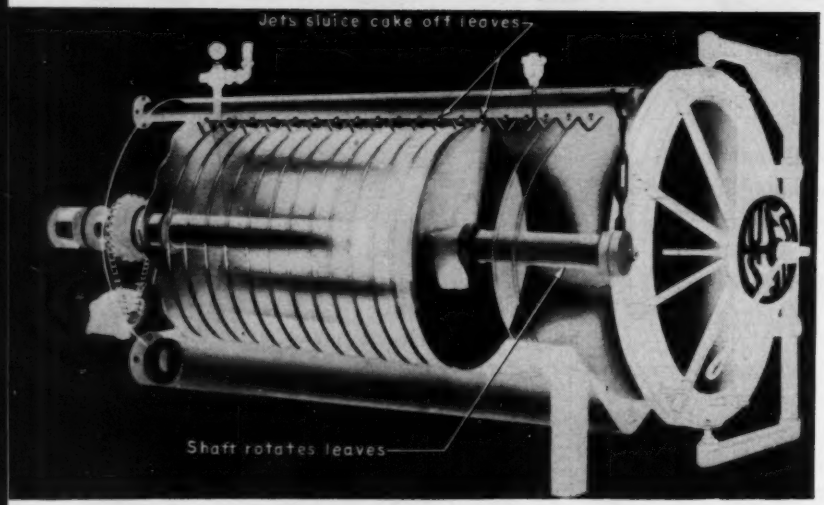
Large plants or small—for continuous or batch processing—Foster Wheeler's long experience in fat splitting, fatty acid distillation and fractionation, esterification, hydrogenation and derivative production can contribute much to the *dependable* and *economical* operation of any installation. We will be glad to demonstrate the advantages of this FW "know how" by quoting on your immediate or future requirements. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

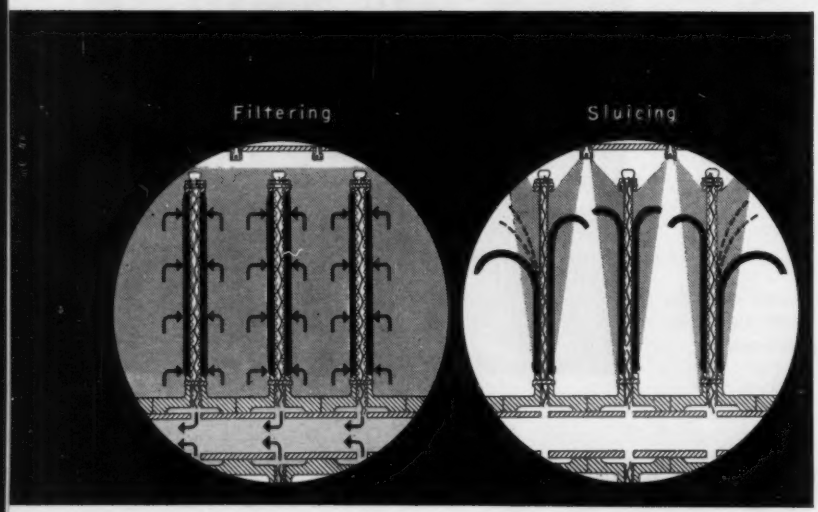


Interior of Compania BAO fatty acid distillation plant, showing still and main condenser on upper level and product receiver directly below. This FW-designed plant processes 1500 lb of crude fatty acid per hour.

FOSTER WHEELER







Leaf Filter Is Self-Cleaning

Jets use fraction of normal backwash; unit is rugged, doesn't blind with fines.

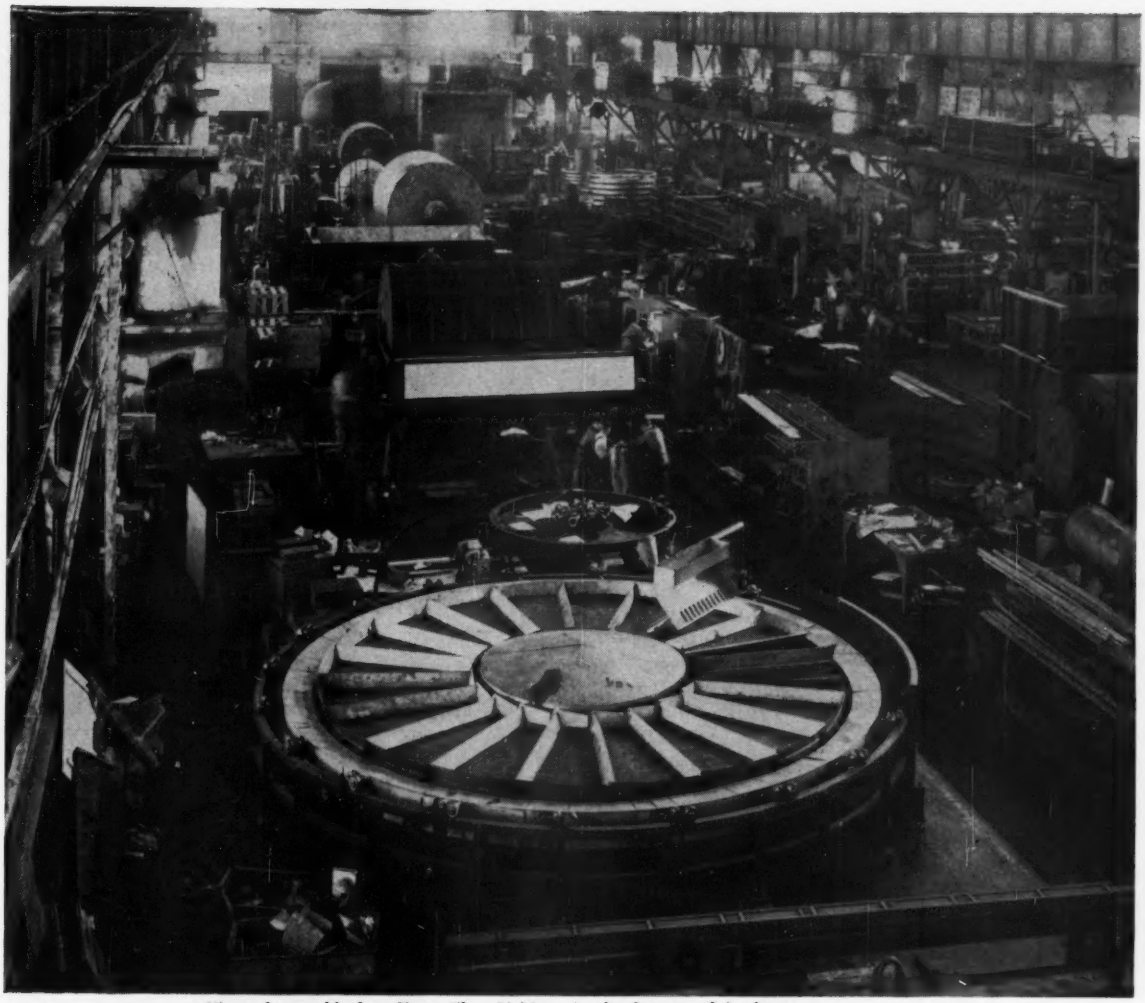
Taking heed from previous woes reported by operators of self-cleaning vertical-leaf filters, U. S. Filters Co. has introduced the new Auto-Jet design that is reported to operate reliably on continuous service.

Significant changes claimed over previous designs include tank, screens and jets that can endure continuous, heavy usage. Automatic controls, too, have been perfected to give long operating service. With these improvements, U. S. Filters feels that it has a unique, self-cleaning vertical-leaf filter.

▶ **Where It's Caught On**—Already, a number of Auto-Jets are installed and operating. One Western sugar company installed five units to replace 11 filter presses early in the summer of 1955. At that time, total savings were estimated at approximately $27,000 for the 120-day 1955 campaign. These would be realized through a 9-man reduction in the labor force and slashing of filter cloth requirements from 8,500 to 1,500.

Standard Oil Co. of California uses the Auto-Jet to filter brine for the secondary recovery of oil. American Potash & Chemical Corp. has a unit installed and two more budgeted for its borax plant. And American Lithium Chemicals has them for its new San Antonio lithium plant.

▶ **Compact, High Capacity**—To obtain maximum filter area within a small horizontal tank, Auto-Jet leaves are mounted vertically on 3-in. centers on a horizontal trunnion. All the area on both sides of each leaf is actively utilized. Thus, a standard 500-ft unit requires a tank only 84 by 54 in. Filter sizes range from 10 to 1,000 sq.



View of assembly bay Eimco Filter Division. In the foreground is shown 120 sq. ft. pan filter, all stainless steel construction for phosphoric acid.

SPECIFY EIMCO FILTERS FOR GUARANTEED PERFOMANCE

Eimco filters are built to meet the exacting requirements of process engineers all over the world.

The wide range in types of filters available at EIMCO include both vacuum and pressure designs in: Drums, Discs, Agidiscs, Top Feed, Dewaterers and Dryers, Pans, Tubular elements and Plate and frames. Each of these designs is available with numerous attachments for cake dewatering and cake removal. Materials of construction are selected with regard to the material to be filtered.

Every filter job receives individual attention at Eimco. The Eimco filter delivered in your plant provides you with the finest filtration equipment you can buy at any price and with a machine guaranteed to perform on your product.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • **Export Offices: Eimco Bldg., 52 South St., New York City**

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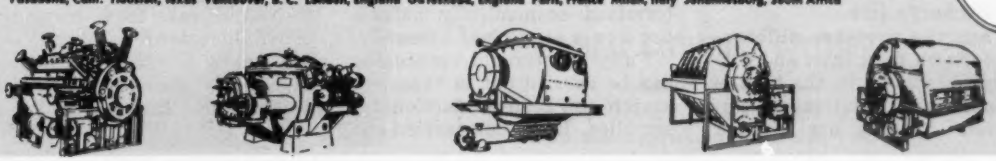


B-175

ft. to handle flows up to 1,440,000 gal. per day.

Tank has a dual-purpose manifold that introduces feed and discharges sludge during cleaning. This feature eliminates costly manifolding of multiple inlets and drains.

A Roto-Lok door allows quick access to the tank for inspection of filter cake and internal parts.

▶**Leaf Design**—A heavy, rigid-mesh center screen forms the foundation of the leaf and serves as the drainage channel. Intermediate screens, on each side of the base screen, cushion the outer covering to prevent excessive wear, corrosion or fatigue. The three-screen assembly of the leaf is firmly encased at the rim by a U-shaped outer frame.

The fine-mesh outer covering or screen is laid on the outer surfaces of the intermediate screens and secured in placed with bolting rings. This outer covering is replaced easily; the inner three-screen base need never be changed.

▶**Jet Cleaners**—Each jet shoots a split stream of liquid against two screen surfaces simultaneously. The screens rotate slowly so that each portion of the leaf comes into contact with the most effective arc of the jet spray. A leaf alignment guide assures that the leaves will be positioned correctly to receive the full effect of the jet spray.

▶**Filter Cycle**—The Auto-Jet cycle consists of precoating, filtering and sluicing.

Recommended precoat is asbestos because it is inherently non-plugging. Also, it will not drop the filter cake if flow or pressure are interrupted. However, other materials such as diatomaceous earth, Perlite, activated carbon or colloidal clay can be used equally well.

Feed to the filter passes through the precoat layer on each side of every leaf. Once inside the leaf, the highly polished liquid drains into the central filter shaft and out into the discharge line.

When the pressure differential between filter inlet and outlet reaches 25-30 lb. the tank is drained and sluicing commenced. Screens are cleaned completely within 3 to 5 min. removing up to 52 cu. ft. of sludge, for example, from a 500 sq. ft. filter. Sludge is removed through the dual purpose manifold under the bank of filter leaves.

Sluicing completes the cycle and the Auto-Jet is then ready to start a new cycle. Cycle time may vary from 4 to 120 hr. or more.—**United States Filter Co., 17 Morlan Pl., Arcadia, Calif.** 234A

Backwasher

Overcomes fouling troubles in demineralizers, softeners, filters.

Backwash troubles encountered with filtration and ion exchange materials are being overcome with a sub-surface washer, it is reported.

Many waters not turbid enough to justify clarification still contain enough soluble solids to plug softeners and filters. Ordinary surface-washing devices are unable to open the beds and proper backwashing is hindered.

Through the sub-surface washer, solids deposits are broken up to prevent fouling of the bed and to permit effective backwashing at normal rates. Channeling and short circuiting are avoided as are excessive backwash rates that cause loss of ion exchange resin.—**Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y.** 236A

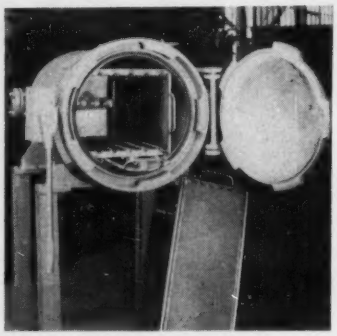
Pilot Reactors

Duplicate action of full size units.

The difficult transition from lab-scale continuous processing to full plant production is eased by resorting to new Flowmaster continuous reactor and mixing assemblies. For the first time, methods and cycle time on a production setup can be determined economically beforehand on a semi-plant assembly.

Fully continuous processes can be carried out in these research and semi-production assemblies. Reactions carried out in the pilot-plant mixer-reactors can be duplicated exactly in plant size Flowmasters.

During the reaction the reactor can receive additives at any time. Also, it acts as an efficient heat exchanger. It can alkylate, hydrolyze, oxidize, polymerize, esterify, sulfonate, and saponify.—**Marco Co., Inc., Saginaw, Mich.** 236B



Pressure Filter

Has recovery leaf to handle unfiltered residue.

A new line of pressure leaf filters utilizes a separate recovery leaf to filter residue left in the filter at the end of the batch. This Model HB unit greatly simplifies continuous processes which operate on a number of crude materials. Gains are reported for refineries that change products, formula and treatments.

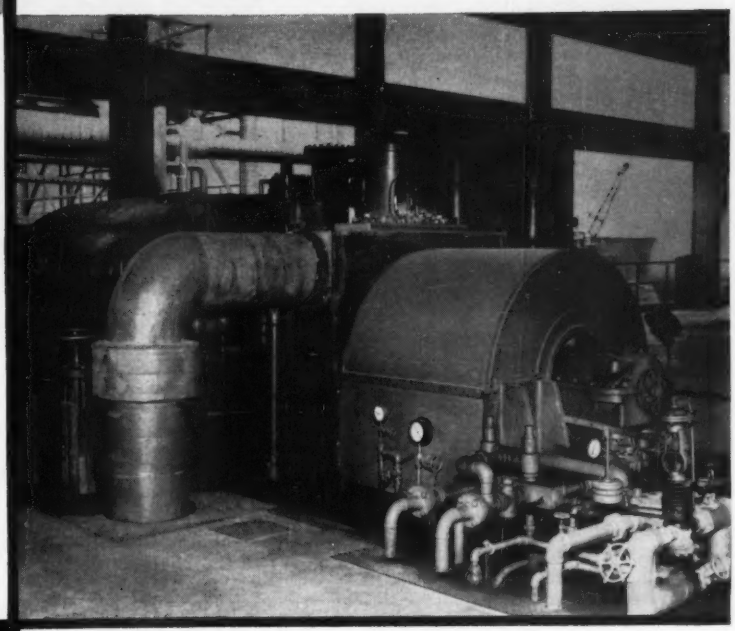
On startup, all leaves including the separately connected recovery leaf are subjected to feed circulation to obtain clear filtrate. During the filtration cycle, cake is held on the recovery leaf by maintaining partial flow at low differential.

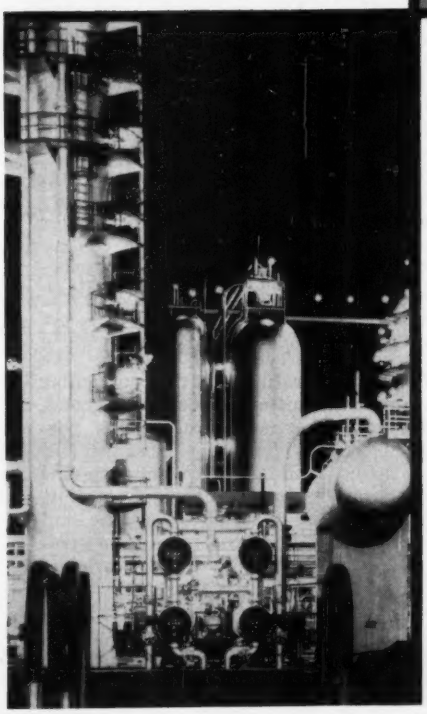
At the end of the regular filtration, residue in the tank is blown through the recovery leaf with air or inert gas. Filtrate is clear because the cake has been held intact throughout the main filtration cycle.

During blowdown the main leaves are also subjected to minimum pressure differential to prevent cake from dropping. When blowdown is completed the cakes can be washed or blown dry with air.—**Process Filters, Inc., Buffalo, N. Y.** 236C

ROSS®

ROSS EXCHANGERS cool lube oil for I-R turbo-blowers at giant Esso cat cracker





Compressing 52,000 cfm of air for catalyst blowing in Esso's giant Bayway, N. J. cat cracker — one of the world's largest — this Ingersoll-Rand Turbo-Blower (one of two) is driven by a 4530 hp I-R Turbine.

To protect bearings and other vital parts with temperature-safe lubrication, twin Ross Type CP Exchangers were factory-furnished with each unit. Dependable oil cooling is continually assured!

At work in refineries around the world, Ross Exchangers not only serve engines, compressors and other primary equipment, but also the more specialized distillation units themselves — wherever there is a heating, cooling or condensing requirement. Top rated for thermal efficiency and ruggedness, they're the No. 1 choice of machinery builders and refiners alike.

Easy to install and easy to maintain, Ross Exchangers are pre-engineered, fully standardized and promptly available in a wide range of designs and sizes to meet your needs, *no matter how special!*

For detailed information, request Bulletins 1.1K5 and 2.1K5.

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ROSS HEAT EXCHANGER PRODUCTS

Infrared Analyzer

Dispersive type, for pilot plants.

Versatility and easy adaptability in determining material balances and over-all yields make Model 176 dispersive infrared analyzer especially suited for pilot plant operation. Instrument combines features of a precise, highly sensitive laboratory spectrophotometer with the heavy duty dependability of commercial instrument.

Analyzer's dispersive design uses a prism-slit optical arrangement to permit handling mixtures that absorb varying wavelengths. Further, this design feature allows the instrument to be adjusted easily to new problems. — **Beckman Div., Beckman Instruments, Inc., Fullerton, Calif.** 238A

Infrared Analyzer

Non-dispersive, for difficult process streams.

The Cary Model 70 infrared analyzer is a dual beam, nondispersive instrument that permits analytical control of difficult process streams. Employing selective detectors, analyzer measures loss of energy of an infrared beam passing through the sample.

Since the instrument is positive filtering type, the selective detectors do not respond to radiation outside the useful wavelengths' regions. They have a high inherent discrimination against other sample components that absorb outside these regions. — **Applied Physics Corp., 362 West Colorado St., Pasadena, Calif.** 238B

Valve Actuator

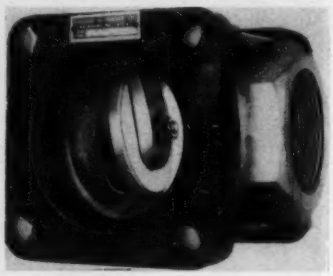
Fills missing link in electronic control systems.

Designed for use with electronic control systems the Electro-hydraulic valve actuator eliminates need for air pressure to operate the control valve.

Actuator is a complete self-contained unit including control valve, hydraulic power source and proportional positioning mechanism. It can be used with existing electronic controllers.

Signal current from the controller is applied to a high-resistance coil which moves in a magnetic field. Linked to the coil is a jet pipe that converts the electrical signal of less than 50 milliwatts into the powerful stroke of a control valve.

Valve moves at better than 1 in. per sec. with total stroke length of 2 in. Thrusts of 600 lb. and more can be handled.— **Askania Regulator Co., 240 East Ontario St., Chicago 11, Ill.** 238C



Sight Flow Indicator

Combines indication with check of back flow.

For the first time, flow indication has been combined with positive checking of back flow in the Fig. 213 bull's-eye check-valve indicator. Designed primarily for LPG and anhydrous ammonia service, indicator has been approved for the former.

Device has a self-aligning soft-seat flapper to prevent back flow. Two ½-in. thick windows on opposite sides of the body fitting show clearly whether or not there is flow. Indicator does not measure rate of flow.

Standard sizes are for 2-in. pipe rated at 250 psi. and for 1½-in. pipe rated at 300 psi.— **Fischer & Porter Co., Hatboro, Pa.** 238D

Flow Integrator

Without cams operates on centrifugal principle.

Pneumatic integrator, model 14A, provides continuous linear integration of industrial process flows to within ¼% accuracy. Instrument is unique in that no cams are needed for extracting square roots.

A 3-15 psi. signal from a transmitter is applied through a bellows to position a force bar in relation to a nozzle. The resulting back pressure at the nozzle, amplified by an air relay, regulates a jet of air onto the blades of a turbine wheel.

As the wheel revolves a centrifugal force is produced by a weight pivoted on the wheel. This force is fed back to the bar to balance the measurement signal. The revolving turbine wheel is geared to a counter which totalizes the flow.

A flow change is instantly reflected in a change of wheel speed and a rebalancing of forces. The centrifugal principle extracts the square root factor introduced by the differential pressure measurement so that integration of flow is linear. — **The Foxboro Co., Foxboro, Mass.** 238E

Temperature Transmitter

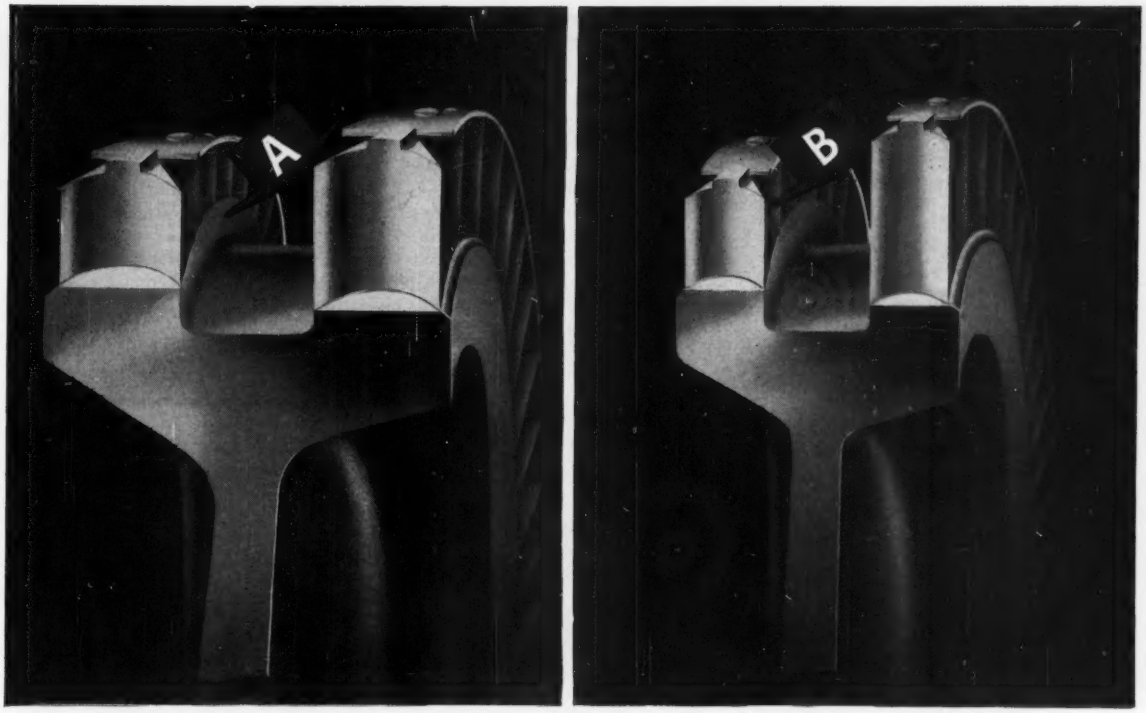
Gives readings from remote location.

Securing temperature readings from remote locations is no problem for the new ST-8900 remote temperature reading system. It gives accurate, temperature reading from any point where communication facilities can or do reach.

Readings are obtained in a manner similar to remote gaging by the manufacturer's Telepulse system. A start or trigger pulse is sent from the control or reading station to the transmitter. This starts the indicating cycle.

First, a series of pulses starts the process of reading the temperature at the particular transmitter selected. Second, another series of pulses positively identifies the transmitter by sending appropriate signals back to the control station. Third, a series of pulses sent back to the control station gives a direct indication of product temperature.

Normal reading span is 130 F in 1-deg. steps. Top temperature limit is 500 F.—**Shand & Jurs Co., Berkeley 10, Calif.** 238F



(Left, A) wide bucket "L" type wheel. (Right, B) regular type wheel for Coppus Steam Turbines

Now...for low steam consumption – **COPPUS TURBINES** *can be furnished with wide bucket "L" type wheel*

Good news for steam turbine users where low steam consumption is important!

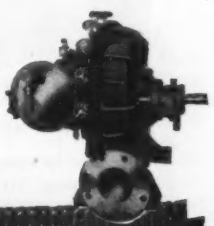
The Coppus Type "L" Wheel is the answer to this problem. Larger turbine buckets are employed to make the most economical use of steam.

In every respect the Coppus Turbine offers the top-quality features and advantages that have made the Coppus line outstanding for efficiency and economy. For example:

- Turbines rated close to your exact hp requirements, from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed safety trip supplementing constant speed governor.
- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.

Coppus Steam Turbines ranging from 150 hp down to fractional, in 6 frame sizes, *make turbine dollars go farther.* Send for Bulletin 135 on Coppus Turbine.

COPPUS ENGINEERING CORPORATION
222 Park Avenue
Worcester 2, Mass.
Sales offices in THOMAS' REGISTER



COPPUS "BLUE RIBBON" TURBINES

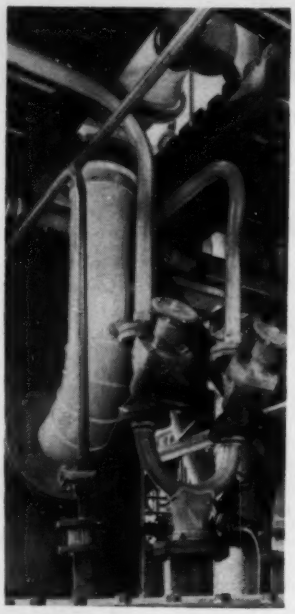
Gage Snubber

Protects instruments on high pressure applications.

A new high-pressure gage snubber protects instruments against line surges and pulsations on systems having total pressure increments as high as 60,000 psi.

Snubber element consists of a series of porous metallic disks assembled inside a housing. This element is available in standard porosities for use with a wide variety of liquid viscosities and gases.

Snubber resists plugging and will not erode. Standard disks are Type 316 stainless steel, but monel, nickel and other metals can be furnished if needed. Element can be cleaned by immersing it in a boiling solution of 15% nitric acid or 15% caustic soda.—**Chemiquip Co., 460 West Broadway, New York 12, N. Y.** 240A



Rigid PVC Pipe Now Handles Chlorine

You are looking at large and small piping, fittings and valves of rigid PVC installed in a chlorine drying and liquefaction plant. The rigid, non-plasticized material in these Ryertex-Omicron pipes conveys both dry and moist chlorine gas satisfactorily. Supplied in Schedule 40 and 80 pipe sizes, it can be sawed, threaded, solvent welded and heat welded.—Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill. 240B

Ball Valve

Completely new, simplified design.

A new Top Entry ball valve that is simple and easy to install and operate has been introduced recently. It is ideal for handling oxygen and hazardous liquids, as well as water, oil and gas.

Direction of shutoff can be changed rapidly by removing the body cap without taking the valve out of the line. At the same time the valve can be cleaned and the seat material changed. Seat can be furnished in Buna-N, Kel-F, neoprene, Teflon and nylon. The stem design can be placed in any of eight positions.

Valve is available with sweat or screw ends in ½, ¾ and 1-in. sizes. It carries 300 psi. water, oil and gas; 400 psi. LP gas.—**Rockwood Sprinkler Co., 38 Harlow St., Worcester 5, Mass.** 240C

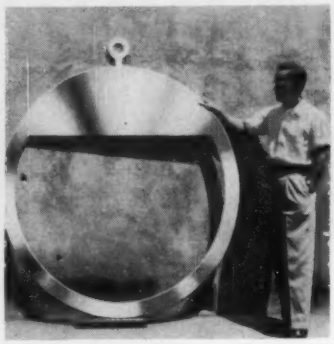
Air Cleaner

Gains efficiency with filter aid.

Extremely high cleaning efficiency, moderate cost and nearly complete freedom from maintenance expense are reported for a new air-cleaning system. Equipment is used on the same high-removal jobs now being serviced by units such as disposable or viscous filters and low voltage electrostatic precipitators. But it's claimed substantially more efficient than other general air cleaning devices against extremely fine atmospheric dust and tarry matter.

One installation now operating on 720,000 cfm. of city air reduces the dust content from 5.21 to 0.04 milligrams per 1,000 cu. ft.

The Ultra-filtration system employs conventional tubular cloth filters. Bags are charged with a filter aid as a precoat material. One application of filter aid will last from two to three years under normal conditions. And it is highly effective trapping fine dust particles and tarry matter.—**Wheelabrator Corp., 1034 Byrkit St., Mishawaka, Ind.** 240D



Orifice Plate

For large-flow gas measurements.

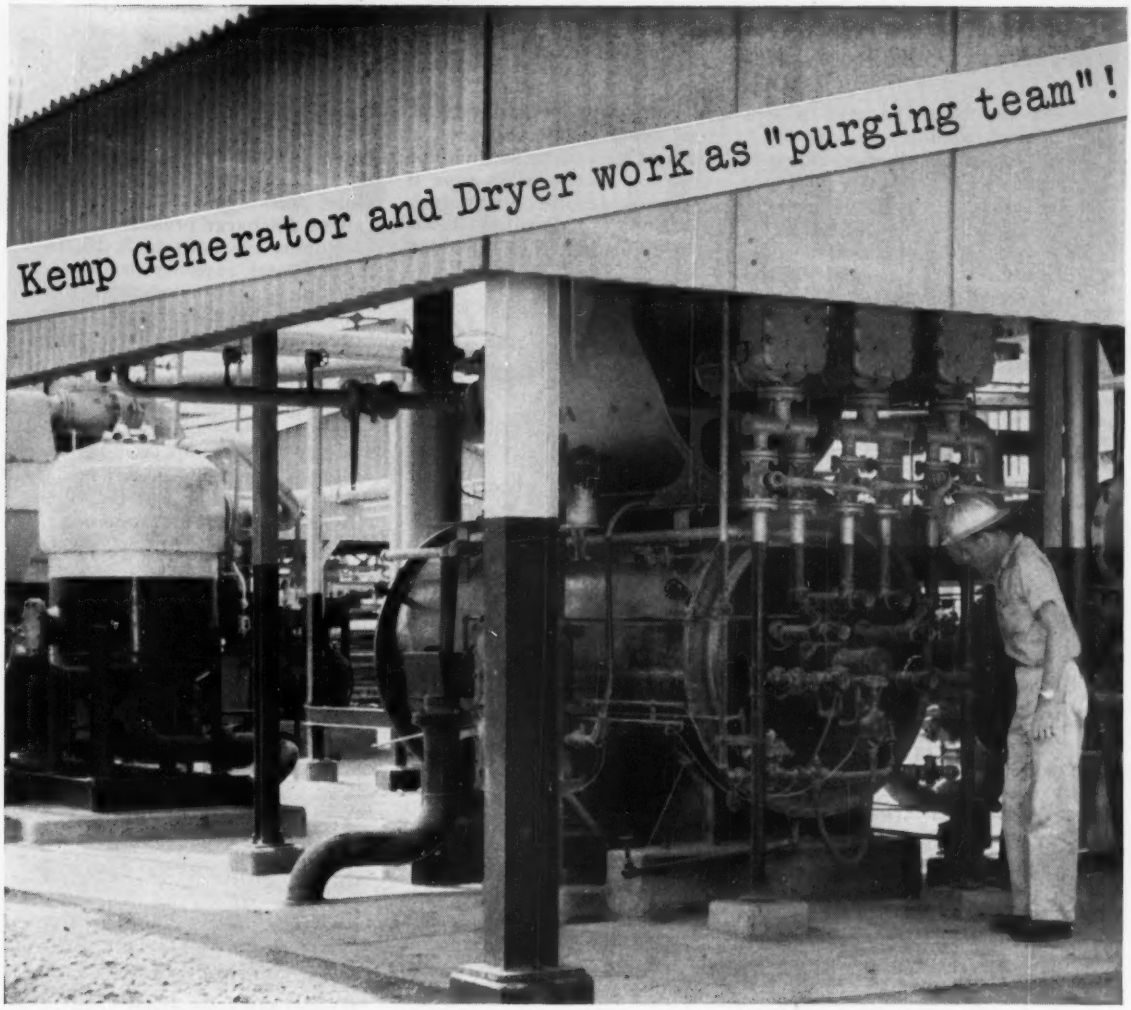
Large 60-in. segmental orifice plate shown was constructed for measuring flow of coke oven gas in one of the larger steel plants. Segmental design gives accurate flow measurement despite presence of foreign substances or liquids which sink to the bottom of the line.

Orifice plate is built of ¼-in. stainless steel. To assure accurate measurement, plate had to be constructed with perfect radius and accurately milled corners. Company builds line of differential-pressure flow measurement equipment from ½-in. to 60-in. sizes.—**Daniel Orifice Fitting Co., 3346 Union Pacific Ave., Los Angeles, Calif.** 240E

Plastic Pipe

In five pressure ratings to save user money.

Users now may purchase Kralastic pipe to meet specific job requirements with working pressure ratings of 50, 75, 100, 125 or 150 lb. Thus, you can



Gulf Oil Reports: *Pipe line purging problems solved by Kemp Gas Generator and Kemp Dryer*

At Gulf Oil's Port Arthur, Texas refinery, dry inert gas is required in the Ethylene Plant for purging pipe lines, tanks and vessels.

Kemp Units selected to do the job

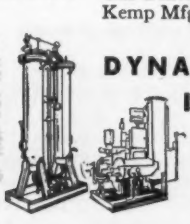
To insure a constant supply of gas—sufficiently dry and free of oil vapors—Gulf installed both a Kemp Inert Gas Generator and a Kemp Convection Type Dryer. The units work as a "purging team"...the Kemp Generator produces 30,000 SCFH of inert gas which is compressed and passed through a Kemp Pre-filter to remove all moisture prior to entering the gas receiver. The result is an efficient, easily controlled source of dry inert gas at all times.

Kemp can solve your problem too

Whether your needs involve dry gases, inert gases—or both, Kemp can help you to the most profitable solution. Kemp Inert Gas Generators automatically deliver clean, controlled atmospheres at specific analysis, without fluctuation—regardless of demands. A variety of Kemp Dryers are designed to dry air, gases or liquids to sub-zero dew points and are available with manual, semi-automatic or fully automatic tower reactivation. In addition, Kemp will specify the proper desiccant for the job.

For complete facts and technical information on Kemp Inert Gas Generators and Kemp Dryers, write today to: The C. M. Kemp Mfg. Co., 405 East Oliver St., Baltimore 2, Maryland.

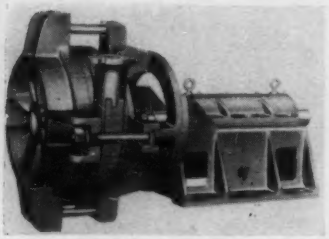
KEMP OF BALTIMORE



DYNAMIC DRYERS
INERT GAS GENERATORS
CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • SINGEING EQUIPMENT

select the pressure-rated pipe you need without paying for more expensive high-working-pressure pipe.

A safety margin five times greater than the theoretical burst strength is maintained in all pressure-rated groups. Pressure-rated pipe maintains the same outside diameter regardless of pressure rating. This standardized diameter eliminates the need for multiple fitting inventory. — **Southwestern Plastic Pipe Co., P. O. Box 117, Mineral Wells, Tex. 240F**



Slurry Pump

For heavy, continuous duty.

A new heavy-duty slurry pump, the type RX, handles abrasive slurries of cement, sand, coal, chemical sludges, plant wastes and other products. Available in seven models from 2 to 6-in. size, pump operates at low speed continuously.

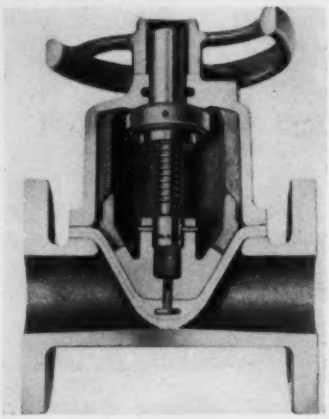
Stuffing box of pump is subject to suction pressure only. Wearing parts can be reached without disturbing the piping; the rotating element can be adjusted to take up wear. Liners on both sides of the impeller are renewable. — **Morris Machine Works, Baldwinsville, N. Y. 242A**

Armored Glass Pipe

Holds together in case of failure.

Pyrex brand armored glass pipe features a new type of Fiberglas protective coating designed to hold the glass together in case of failure. Armor sleeve will carry the rated load of the pipe indefinitely, it is said.

Armor consists of a seamless sleeve of Fiberglas fitted snugly over the glass pipe and impregnated with polyester resin. Once the sleeve has cured it forms a tight-fitting second pipe as strong as the glass pipe it surrounds, despite being only ⅛ in. thick. — **Corning Glass Works, Corning, N. Y. 242B**



Diaphragm Valve

Designed for straight-through flow.

Grinnell-Saunders Straightway diaphragm valve (patented) offers straight-through flow for handling viscous materials, fibrous slurries, sludges, semi-fluids and solids in suspension.

Advantages featured include: ability to handle viscous material without restriction or stoppage, minimum pressure drop, rodding or brushing without removing valve bonnet and without possible damage to body linings, self drainage when pipe line is pitched sufficiently to drain the piping.

In addition, this valve retains all of the advantages of the conventional Grinnell-Saunders weir type diaphragm valve.— **Grinnell Co., Inc., Saunders Valve Dept., 260 West Exchange St., Providence 1, R. I. 242C**

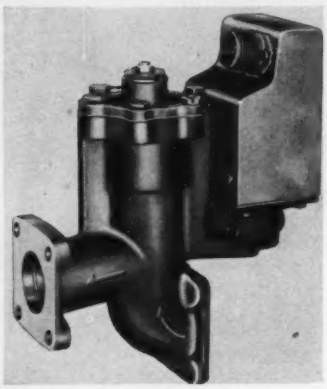
Controlled Pump

Meters against negative discharge pressure.

Based on a unique pumping concept, the new Minus Delta P controlled volume pump meters low capacity flow from high inlet to lower discharge pressure. Units are immune to pressure variations in the system. All that's required is that inlet pressures be at least 5 psi. above discharge pressure.

Pumps are built in 3, 15, 75 and 375 ml. capacity per cycle. Capacity is adjusted manually or automatically during operation through either stroke length or speed control.

Construction is leakproof with no running seals or stuffing box. Pump chamber is completely scavenged to assure highest metering accuracy at all times.—**Milton Roy Co., Station L, 1300 East Mermaid Lane, Philadelphia 18, Pa. 242D**



Regulator-Shutoff

Two-in-one valve for high temperature air or gas.

A new modified self-regulating globe valve operates both as a hot air shutoff and pressure regulating valve. It can function with inlet temperature over 1,000 F. at an ambient temperature of 500 F.

Valve holds downstream pressure constant with inlet pressure varying over a wide range. The pressure regulating pilot is a spring-loaded, piston-operated needle valve which modulates air pressure above the main piston. Valve opens or closes by remote control of a solenoid-operated bleed valve which overrides the action of the pressure regulating pilot.

Now used on jet aircraft, valve 35-079 appears interesting for industrial application. — **Hydro-Aire, Inc., 3000 Winona Ave., Burbank, Calif. 242E**

NEW!

Porous stainless steel (15-diameter magnification)

Cuno PORO-KLEAN filter stops 3-to 30-micron particles at 900°F

Cuno's new PORO-KLEAN offers true micronic filtration at temperatures that melt tin, bismuth, cadmium, lead or zinc.

High temperatures, high viscosity, high pressure drops and corrosive fluids don't faze this new filter.

It's all metal—absolutely lint-free. There's no contamination of the filtered fluid.

It's strong. PORO-KLEAN filters already in operation take a pressure drop of 1500 psi. PORO-KLEAN porous stainless steel has been used for structural parts in aircraft to achieve boundary layer control and transpiration cooling.

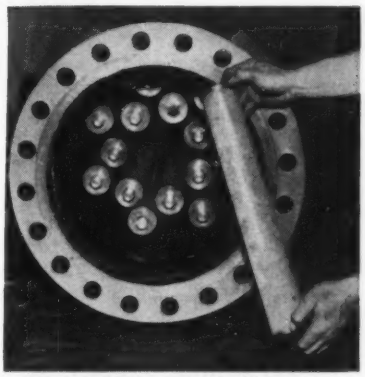
It's corrosion resistant. Standard in 316 stainless steel. Low carbon content (0.03 to 0.05% max.) prevents carbon precipitation at welds or during fabrication.

It's easily cleaned—in place, by backwashing with pre-filtered fluid or inert gas; or, when removed, with suitable solvent. May be sterilized with live steam for food or drug processing; or will filter rust and scale from steam used for other cleaning or sterilizing.

Its porosity is closely controlled. Four standard grades cover the range from 3- to 30-micron statistical particle retention.

Standard designs. For most applications standard housings and elements are available.

Get all the facts on Cuno's new PORO-KLEAN filter for your chemical or process applications. Write Cuno Engineering Corporation, 31-2 South Vine Street, Meriden, Conn. 53



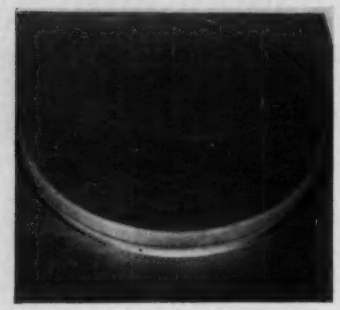
THIS PORO-KLEAN FILTER handles 180 gpm of naphtha at 400°F. Operating pressure: 700 psi ASME Code with 5 psi pressure drop. It's cleaned by back-flushing with nitrogen. Cell-type PORO-KLEAN filter elements (large picture at top) have large surface area. This unit is 54" L x 9" O.D. and is designed for 1500 psi pressure drop and 550°F.

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)



Metal Cutting Process

Speeds fabrication of non-ferrous metals.

A new technique for cutting non-ferrous metals such as aluminum is of interest to chemical engineers because it may make possible fabrication of a wider range of process equipment. For the first time non-ferrous metals can be cut as easily as is steel with oxygen cutting.

The Heliarc method of cutting uses a gas-shielded, constricted arc with extremely high temperature and high velocity between a tungsten electrode and the piece to be cut. Arc cuts rapidly making sawlike edges. Cutting and edge-preparation costs are reduced greatly.

Heliarc cutting is adaptable to mechanized or manual operation. It can cut irregular or curved shapes as well as straight lines.—**Linde Air Products Co., Div. of Union Carbide & Carbon Corp., 30 East 42nd St., New York 17, N. Y.** 244A

Chain Couplings

For positive, compact, direct coupling of shafts.

Flexible, Taper-Lock chain couplings permit sufficient relative movement between the hubs to accommodate slight angular and parallel shaft misalignment. Utilizing Taper-Lock bushings these new couplings install upon full size or normally undersized shafts, yet give the equivalent of a shrink fit.

Chain is double-width standard type conforming to ASA specifications. Additional bearing area of double width allows higher horsepower ratings and longer wear life. Shafts can be disconnected quickly by removing one coupling pin and unwrapping the chain from the hubs.—**Dodge Mfg. Co., Mishawaka, Ind.** 244B

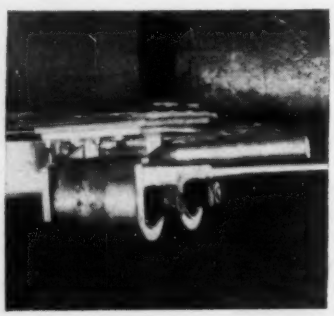
Magnetic Separator

Has more powerful magnet to remove iron contamination.

Now standard on all Eriez drum separators is a more powerful magnetic element, at no appreciable change in cost.

New element provides deeper, more intense magnetic fields so that the drum has high efficiency even when handling extreme depths of material. In the extreme ranges of distance from the drum surface, magnetic strength is as much as 220% greater than in some of the previous models.

Consisting of a revolving cylinder containing a permanent magnetic element, these units remove tramp iron and medium fine ferrous contamination from materials conveyed through spouts, chutes and other systems exclusive of belts.—**Eriez Mfg. Co., Erie, Pa.** 244C

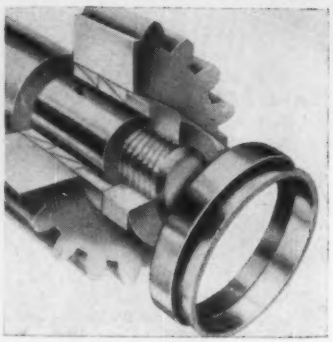


Equipment Movers

Operate like oversized roller skates.

Merely by bolting Mighty Movers onto heavy machinery it can be moved quickly and safely. Furnished as sets of four these dollies can carry loads up to 90 tons. Each dolly is 9 in. long, 5 in. high and wide and weighs 40 lb.

Dolly has two 4-in. roller-bearing cast-iron wheels enclosed by hardened steel sides topped by a swivel plate. After being raised by a mover's jack or fork-lift, machinery is bolted to dolly through a standard ½-in. hole in the swivel plate. Dolly can swing a full 360 deg. —**Mighty Mover Co., 1482 South Milwaukee St., Denver 10, Colo.** 244D



Keyway Replacement

Fastens hub to shaft.

Through a new approach the Gripspring device fastens a hub to a shaft without using spline or keyway. It has all the advantages of a shrink fit without any of its disadvantages.

The Gripspring device is wedged between hub and shaft by applying heavy pressure with easy-to-use hand tool. The outer ring expands and the inner ring contracts.

Gripspring is said to transmit maximum torque for a given shaft diameter because full strength of both hub and shaft is utilized. The straight cylindrical shaft and hub bore eliminate all stress concentrations permitting liberal tolerances on the simple cylindrical surfaces. —**U. S. Automatic Corp., Amherst, Ohio.** 244E

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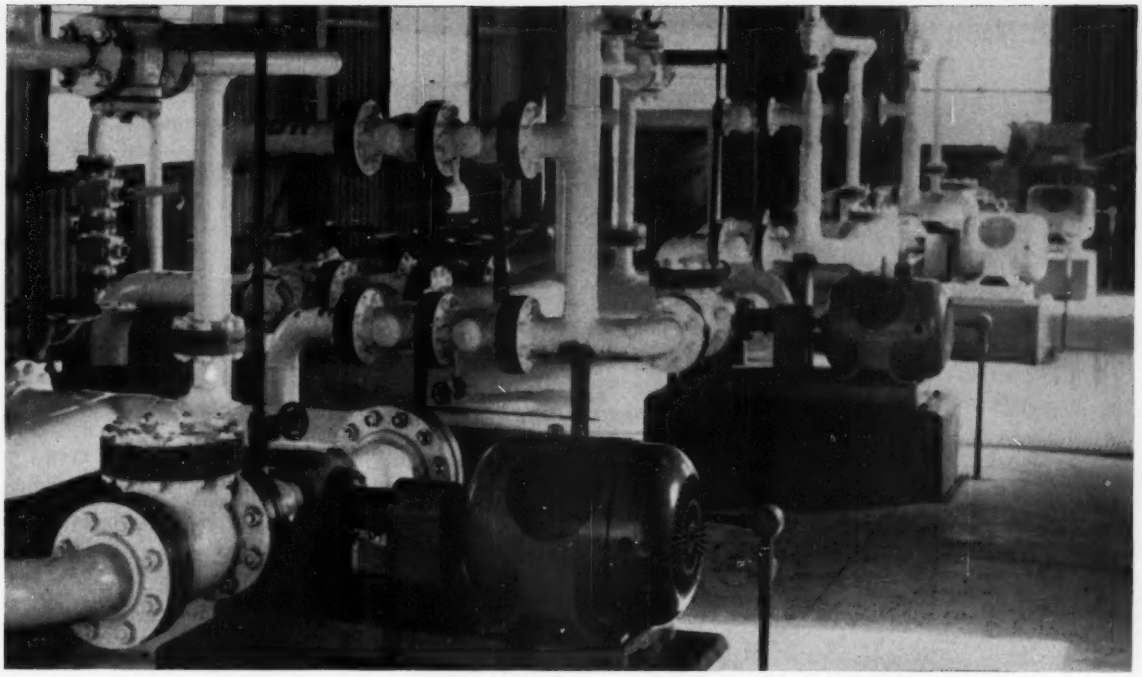

7½ H.P. Century motors drive loading pumps in a processing plant.

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Safety Harness

Halts accidental falls from stagings.

A new automatic safety device permits free movement of worker yet provides absolute safety where falls are a hazard.

Device consists of a sturdy metal box containing an aluminum drum with an automatic safety brake and reel. Either 50 ft. of $\frac{1}{16}$ in. nylon rope or 100 ft. of stainless-steel wire rope are wound on the reel. Box is attached to worker with nylon suspender type harness.

In operation, rope can be withdrawn freely from the box up to a certain speed to allow freedom of movement. If worker falls the high speed withdrawal of the rope actuates the brake to stop the rope. Worker will only fall 2 or 3 ft. before being stopped. He is in a comfortable upright position from which he can be rescued quickly and easily.—**Wind-Kor Automatic Safety Device Co., 3960 North Elston Ave., Chicago, Ill. 246A**

Resistant Gasket

Withstands oil and temperature.

Developed primarily for the oil and chemical processing industries, 662 gasketing material has been approved by Underwriters' Laboratories for use in equipment where harmful liquids are encountered.

Garlock 662 is a cork-base paper impregnated with Chemigum latex. It is satisfactory up to 300 F. and is not susceptible to changes in moisture content. Shrinkage, which often is a critical problem with gasketing material, is eliminated completely with this material. Superior resistance to aging permits 662 to be stored without harm.—**Garlock Packing Co., Palmyra, N. Y. 246B**

Extension Lubricator

Simplifies packing of pump shaft stuffing boxes.

An extension lubricator for injecting lubricant as packing in pump shaft stuffing boxes is now available. Previously, this lubricator was made up by this manufacturer only for individual customers on request. Now it is a stock item to meet the heavy demand from pump users.

Lubricator is made in brass or cadmium-plated steel, overall length is either $6\frac{3}{8}$ or $8\frac{7}{16}$ in. The longer model with larger lubricant barrel can be furnished with either $\frac{1}{4}$ in.-18 or $\frac{3}{8}$ in.-18 N.P.T. thread connector.—**Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa. 246C**

For More Information . . .

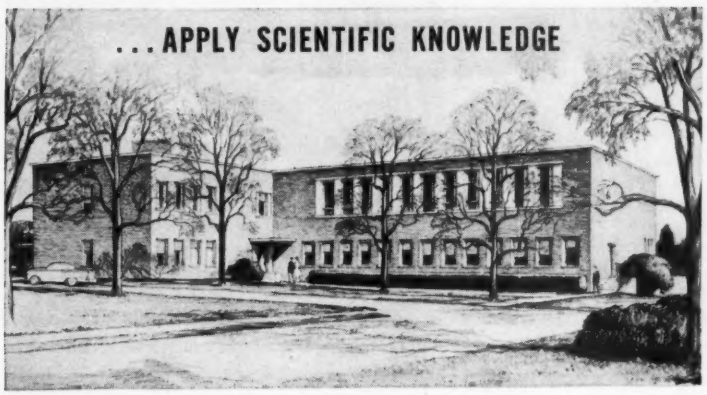
about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.

Sand Scours Pipe Interior Clean

Much pipe that normally is discarded can be reclaimed with this new sand blasting tool. It is said to be the first successful application of the sandblasting principle for cleaning the I. D. of pipes and tubes. Torno-Blast Sandstorm pipe cleaning system whirls sand or other abrasive material under great pressure inside the pipe. A conical diverter disperses the abrasive material over 360 deg. Tool is merely passed through the pipe, is not rotated. Available for pipe from $\frac{1}{2}$ to 12 in. dia.—J. C. Fennelly Co., 1485 Bay Shore Blvd., San Francisco, Calif. 246D

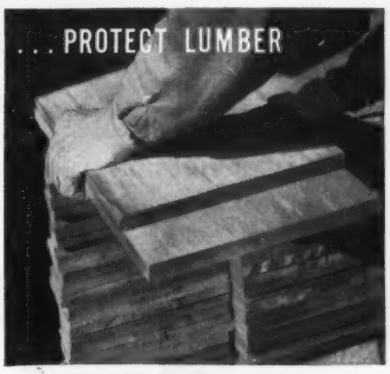
HOW HERCULES HELPS...

IN HEAVY TRAFFIC AREAS like this, floor tiles must be built to take a beating. Whether the tiles are of the rigid, mastic type or flexible flooring based on rubber or vinyl, Hercules Neolyn®, Mastolyn® or Staybelite® resin can contribute to lower processing costs and better wearing qualities. The wide variety of properties offered by these resins assures that there is one best suited for every floor tile formulation.



MORE THAN 17,000 VOLUMES of scientific literature and tens of thousands of company research reports will be housed in this new $1,000,000 Technical Information Center at the Hercules Experiment Station near Wilmington. In addition, the structure will provide quarters for the many technical specialists who serve the scientific information needs of the Hercules research staff—making the Center one of the nation's most complete information services to an industrial research organization.

WHICH HAD THE TREATMENT? The clean, unsplintered piece has been treated with Hercules Paracol® wax emulsion, making it possible to use every inch of lumber that has been pre-cut at the mill. The untreated piece (top) is badly "checked" and a portion of the end must be discarded before it will be suitable for use.



G55-13

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HERCULES

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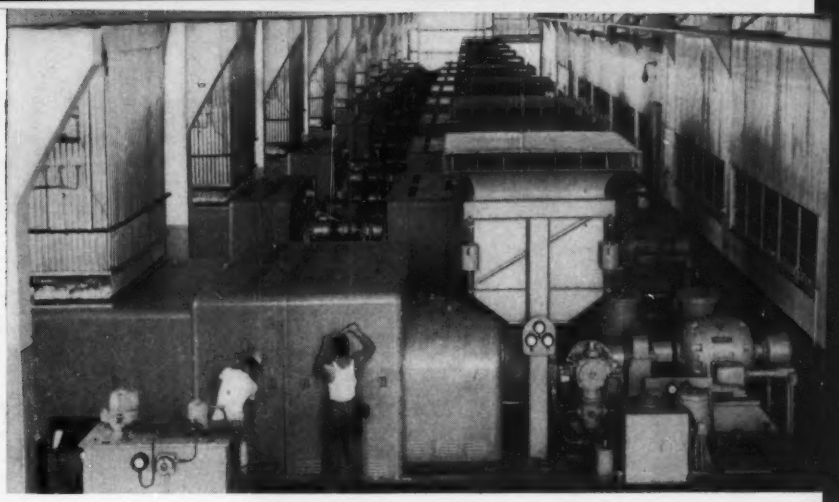
CELESTIAL NAVIGATION—Link Aviation's high-speed, high altitude celestial navigation trainer; only such trainer capable of simulating trans-Polar flight. Trains navigators in techniques of guiding planes by the stars.

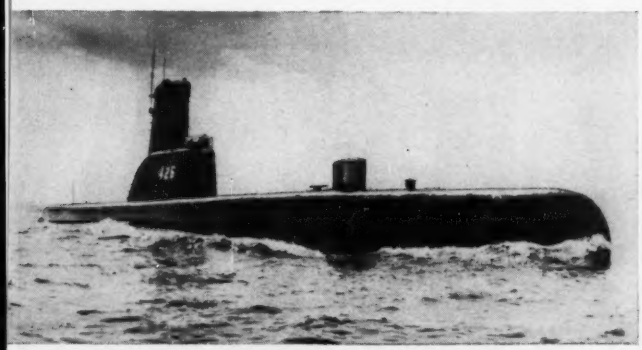
Vital Controls

The controls on the world's fastest submarine; the most advanced airborne navigation system known to exist; other similarly advanced military systems and equally advanced industrial equipment and control systems are outstanding examples of the work of the producing companies of General Precision Equipment Corporation. More than a dozen major industries are served by instrumentation and systems designed, developed and produced by GPE Companies.

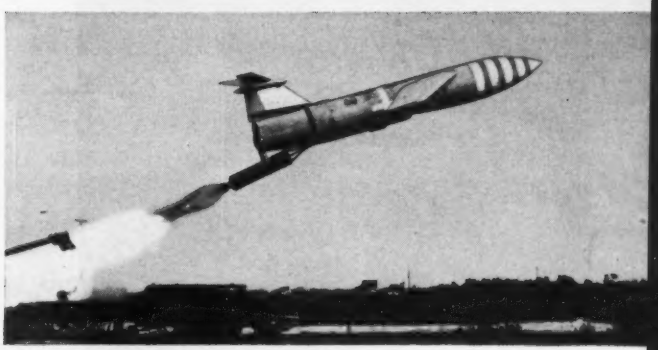
Ten of the companies in the GPE Group—notably Askania, Kearfott, Librascope and Link Aviation—devote substantial resources to the development and manufacture of instruments, servos and controls. These are used in equipment and systems developed by these companies



PROCESS CONTROL—Askania controls regulate speed of the ten turbines which develop compression to maintain gas suction pressure in Creole Petroleum Corporation's giant, pile-supported oil drilling operation on Lake Maracaibo, Venezuela.



SUBMARINE OPERATION — Controls developed and produced by Askania Regulator Company are utilized to govern operation of U. S. Navy's modern Guppy type submarines.



MISSILE GUIDANCE—One of the many guided missiles equipped with Kearfott basic gyro reference systems, the B-61 Matador—U. S. Air Force's first successful ground-to-ground tactical weapon.

GPE CAPACITIES

● Manufacturing
●● Manufacturing and product development
●●● Manufacturing, product development and research
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KEARFOTT COMPANY, INC.	INTERNATIONAL PROJECTOR CORPORATION	BLUDWORTH MARINE DIVISION	GENERAL PRECISION LABORATORY INCORPORATED	THE GRISCOM-RUSSELL COMPANY	LINK AVIATION, INC.	THE HERTNER ELECTRIC COMPANY	THE STRONG ELECTRIC CORPORATION	J. E. McAULEY MFG. CO.	ASKANIA REGULATOR COMPANY	AMPEX CORPORATION	LIBRASCOPE, INCORPORATED	
●●●	●●	●●	□●●	●●	●●●	●●	●●●	●●	●●	●●	●●●	PRECISION MECHANICS, OPTICAL DEVICES, CERAMICS
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	●●			●●●					●●●			HYDRAULICS, LIQUIDS PROCESSING, HEAT EXCHANGE
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●●●			●●●	●●●	●●●				●●●		●●●	SYSTEMS ENGINEERING Aeronautical, Naval, Industrial

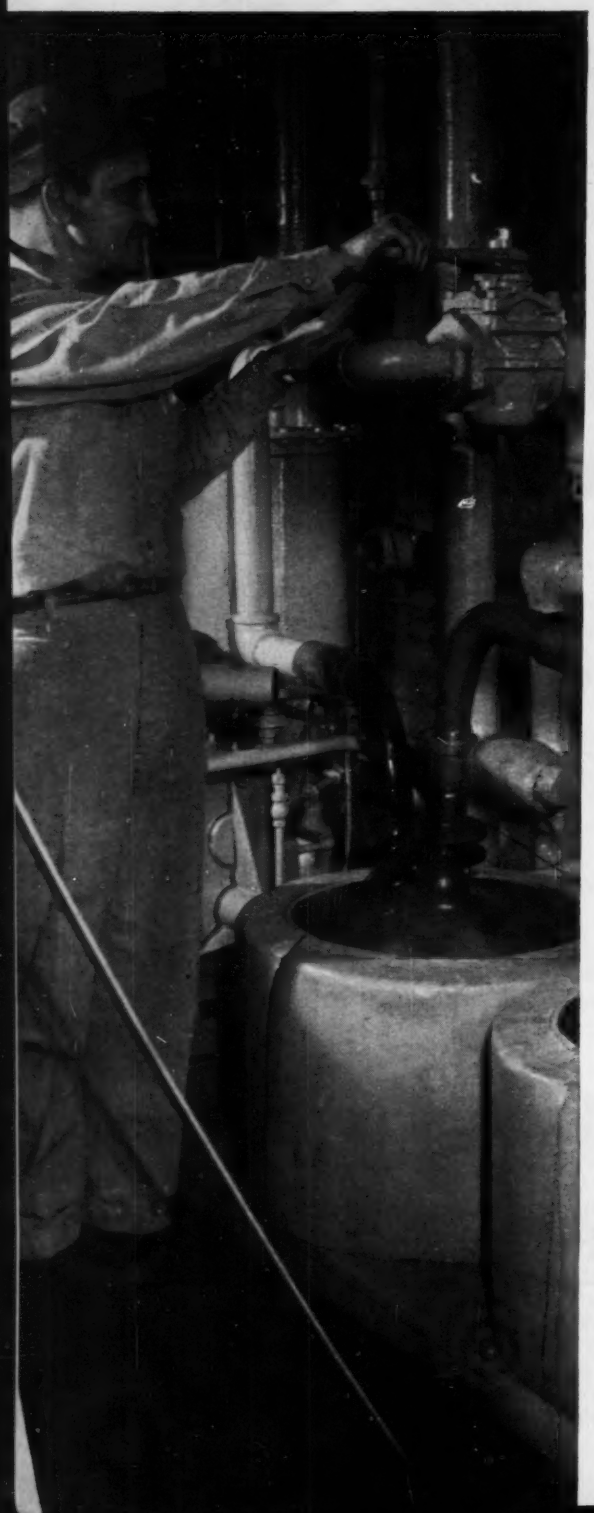
themselves, as well as in systems and equipment developed and produced by other manufacturers of advanced technological equipment.

All GPE Producing Companies work in the advanced areas of highly specialized fields and are engaged in the design, development, manufacture and sale of equipment which is closely related from a technical point of view. It is all precision equipment; it derives from similar fields of technical competence; it saves labor, increases productivity or achieves results which cannot be achieved with even limited use of on-the-spot manpower. The chart here shows the specialized fields in which the key GPE Producing Companies work.

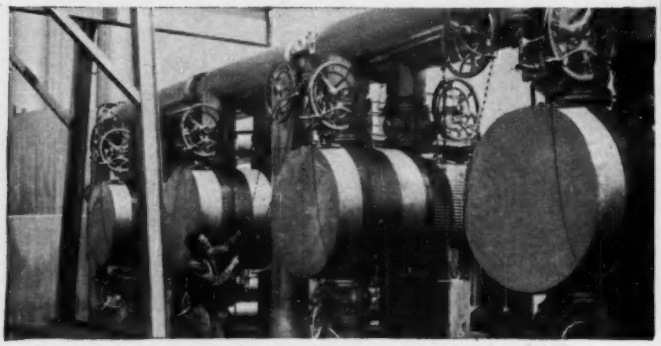
In addition to specialization in its particular products and fields of technical competence, each of these companies has at its command, as required, the facilities and specialized techniques of the other GPE Companies in their respective fields. Interrelation of their resources is achieved through GPE's basic operating policy, GPE Coordinated Precision Technology. In all areas in which GPE Companies work, this coordination has been responsible for a wide variety of precision equipment of superior design and performance, embodying new, advanced principles.

A brochure relative to the work of the GPE Companies and GPE Coordinated Precision Technology is available. Address your request, or specific inquiries, to: GENERAL PRECISION EQUIPMENT CORPORATION — 92 Gold Street, New York 38, N. Y.

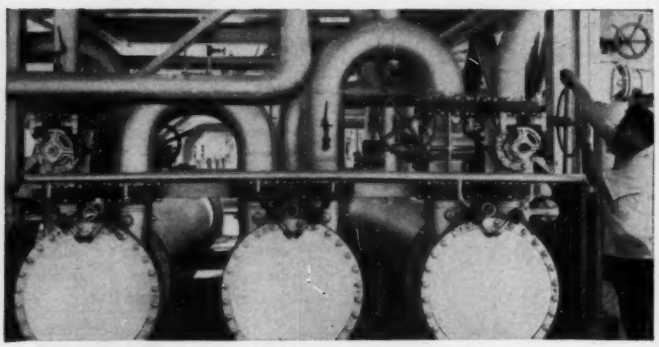
Break Production



PRECISE CONTROL on antibiotic processing at this pharmaceutical plant is assured by the fast, smooth quarter-turn operation of Rockwell-Nordstrom valves.



VERSATILE Rockwell-Nordstrom valves can be used in any position for flow in any direction. Ideal for chain-wheel or extension operating like the heat exchanger shown above.

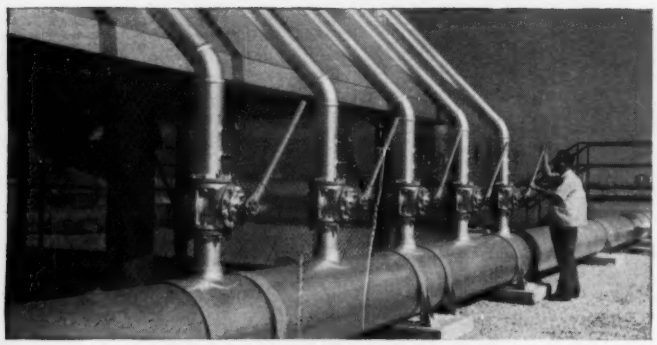


COMPACT Rockwell-Nordstrom valves on the gas coolers above have no stem assemblies or bonnet cavities to take up vital space. Space and weight savings mean real economy of designing and investment.

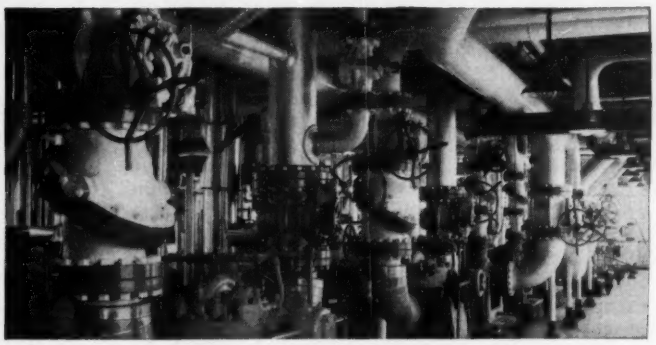
DEPENDABLE, LEAKPROOF Rockwell-Nordstrom valves cost no more, often less, than ordinary valves—but they assure *absolute reliability* on even the most critical service.

Bottlenecks

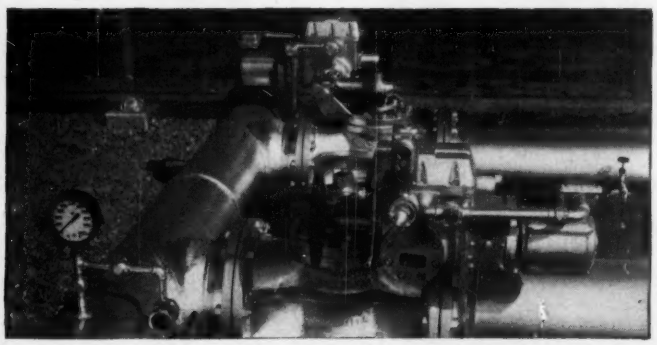
ROCKWELL-Nordstrom VALVES Keep Every Line On Stream



AT A GLANCE, you can tell whether a Rockwell-Nordstrom valve is open or closed. Costly, often dangerous guesswork and old-fashioned "feeling" a valve are eliminated.



BIG . . . BUT FAST. *Every* Rockwell-Nordstrom valve is fully opened or fully closed in one quarter-turn. On gear operated valves, this means operation is two to five times faster.



FOR POWER OPERATION, Rockwell-Nordstrom valves assure dependability and economy because simpler and less costly actuators are required for quarter-turn operation, and lubricant keeps them "ready to go."

For forty years, process engineers have insured better quality control and mechanical performance, greater safety, and lowest maintenance costs with Rockwell-Nordstrom chemical valves. They have been *proven* on every service from the earliest refineries to today's exacting demands of precise flow control in automatic chemical and processing plants. The facts speak for themselves . . . everywhere you use Rockwell-Nordstrom valves they will assure you greater "on stream" dependability at lower cost than any other valve you have ever used.

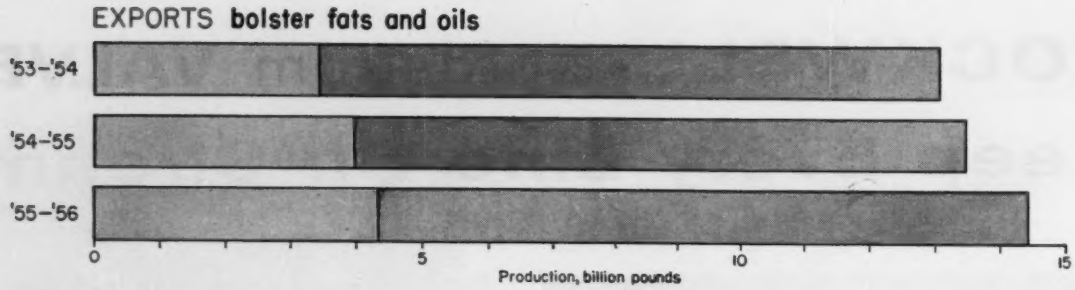
Look at these installation photographs for just a few of the reasons why Rockwell-Nordstrom valves can help you break production bottlenecks. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Limited

ROCKWELL-
Nordstrom
VALVES

Lubricant Sealed For Positive Shut-Off

40th YEAR *of lubricated plug valve leadership*



Research, Exports Brighten Fats & Oils

Record supplies of fats and oils present a disposal problem. Rising exports are today's answer; research is the hope for the future.

Hugh T. Sharp, Assistant Editor

With record supplies here again, the fats and oils industry must once more face its familiar, chronic disposal problem. And exports will have to provide most of the solution.

Last year about 20% of U. S. food fats and oils and about 45% of the inedibles were sent out of the country. And with higher production and little hope for increased domestic consumption, both the percentages and the amounts exported will likely rise.

Abetted by the improving dollar position of many countries and by U. S. government programs that let some buy with their own currency, strong demand from fat-starved nations is now a major factor in controlling our stocks.*

But many U. S. producers contend that they aren't relying on exports to solve their disposal problem. They point to two industry trends (noted here two years ago, *Chem. Eng.*, March 1954, p. 200) which are still building:

- Greater diversion to food uses, including animal feeds.
- Greater activity in research and technology to open more non-food uses.

▶More Go to Edibles—Take last year for instance. When the marketing year ended on September 30th, domestic per capita use of all fats and oils was 65 lb. (fat content). This was up half a pound over the previous year—with all the increase going to food uses.

Fats in food rose to 45.1 lb. per person. Per capita consumption of margarine slid slightly—to 8.0 lb. (actual weight)—while butter use climbed nearly half a pound—to 9.4 lb. (actual weight). Lower prices in the first six months and increased release from government stockpiles to school lunch programs and similar outlets caused the rise in butter use.

Lard and shortening use stayed at 21.7 lb. per person, but lard use alone climbed to 291 million lb. from the prior year's 140 million lb. This jump reflects the price edge lard holds on edible vegetable oils and the results of extensive research that has licked many of lard's former shortcomings — characteristic odor, poor stability and a tendency to smoke. This year it's likely that lard use will again increase.

Another strong upward trend appears in the consumption of cooking and salad oils, etc. Food use has been rising in recent years; last year the increase was about ½ lb. per person.

Continued decline of soap as a major fats and oils outlet is still worrying producers. Last year sales of synthetic detergents climbed another 10% or so while soap sales again slipped about 5%. Detergents now hold nearly two-thirds of the 3.2 billion lb. total market for soaps and syndets.

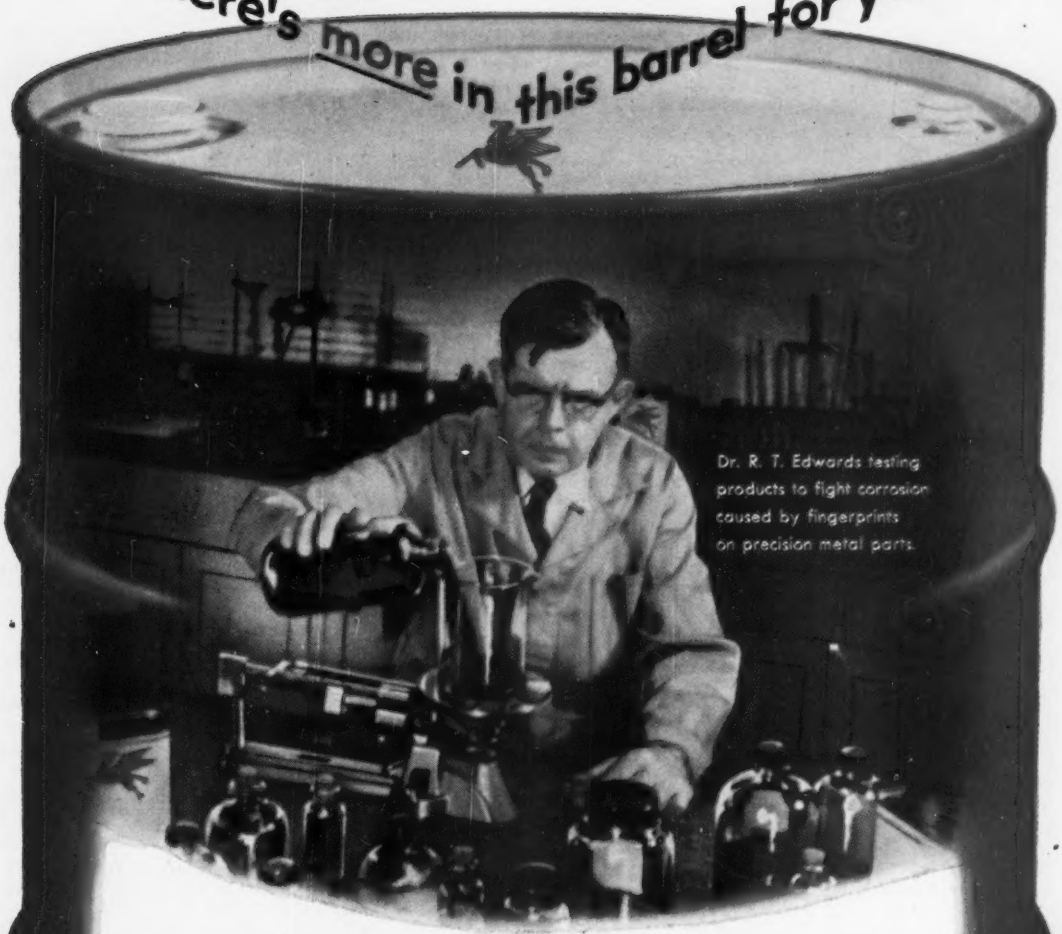
But while the soap market has been drying up, domestic consumption of inedible tallow and greases has remained relatively stable as other outlets have expanded.

▶Research Yields New Outlets—Current research is counted on to find more outlets for all types of fats and oils. Development of cheaper, more efficient separation processes is an important step since purity is so essential in most new uses.

For example, new fractionation processes have made high grade tall oil fatty acids and rosins available cheaply enough to open dozens of uses to them. And during the past ten years tall oil production shot up 250%.

* Sources of data in text and chart: Bureau of Census; Fish and Wildlife Service; U. S. Dept. of Agriculture; Foreign Agricultural Service; and *Chemical Engineering* estimates.

There's more in this barrel for you...



Dr. R. T. Edwards testing products to fight corrosion caused by fingerprints on precision metal parts.

MORE CONTINUOUS RESEARCH

to help you improve production and cut costs!

When you specify "Socony Mobil," you get petroleum products backed by *more continuous research* than those of any other oil company! This means products which are *continually improved* in quality and performance—*new* products when needed. Equally important . . . these complete research facilities are available to *you*—to help improve your production and lower your unit costs.

Socony Mobil products are also backed by *more* field engineers serving industry . . . *more* services for analyzing petroleum products in use . . . *more* on-the-job training of your personnel in correct product application . . . *more* approvals from machine builders . . . *more* practical experience—90 years!

Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY **SOCONY MOBIL** FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

LUBRICANTS · FUELS · CUTTING FLUIDS · WAXES · SOLVENTS · PLASTICIZERS · PETROCHEMICALS

Hand in hand with efforts to get purer products, research is also aiming directly at new uses. The long, straight-chain structures of fatty acids look promising for plastics, synthetic fibers, lubricants, waxes, surfactants. And if a profitable way could be found to go directly to these from fats, say tallow, the industry's long range outlook would be steadier.

Nearly half of last year's tallow production of 2.925 billion lb. was exported. Prime tallow brought 7¢ per lb., so costwise tallow would be a first rate, abundant raw material for a broad range of chemical uses.

▶**Supplies Set Records**—Abundant is the word for most fats and oils right now, not just tallow.

This year, butter production is expected to rise a bit. But since beginning stocks are down to only about 60% of the prior year's, total butter supplies are apt to be slightly smaller.

With lard, though, the tune's vastly different. Three factors should contribute to a supply about 300 million lb. higher than last year's 2.37 billion lb.

- Beginning stocks are greater.
- Hog slaughter should be up 10%. Low hog prices could be a depressant, however.
- Lard yield per hog will likely rise as packers continue to trim more fat from pork.

Greater hog slaughter is also due to boost supplies of inedible oils and greases. They'll probably go up about 100 million lb. in the 1955-56 production year—to about 2.93 billion lb. Beginning stocks are about the same as a year ago and cattle slaughter probably won't change much, so the boost will come from the 10% hike in commercial hog slaughter.

Bigger soybean, cottonseed and peanut crops will likely offset lower initial stocks and add up to bigger supplies of edible oils this year. Record yields pushed the 1954-55 cottonseed crop to 6,119,000 tons, 7% over the previous year. Soybean crop, up 29 million bu. to 372 million, will hike crushings, exports and stocks. And a big improvement—some 716 million lb. to a total 1.74 billion lb.—in peanut production will likely have a smiliar effect.

There'll be more than enough linseed oil to meet domestic needs, though stocks are down about 160 million lb. because of heavy exports. Output of flaxseed is high, but the cut in stocks will lower total supply.

▶**Exports in Starring Role**—Exports play a big part in disposing of these materials. In 1954-55 the United States exported about 2.4 billion lb. of food fats, oils and the oil equivalent of oilseeds. Inedible tallow and greases chimed in with 1.3 billion lb. of net exports (total exports less inports). Edible vegetable oils, soybeans, butter, tallow and greases were sent abroad in record quantities. Lard shipments were up, too, though flaxseed and linseed oil shipments dropped off.

Heavy exports will continue through this year—encouraged by short world supplies of sunflower and olive oils, lower stocks abroad, high economic activity in major markets. Favorable dollar position of many countries, U. S. government programs and competitive prices of many U. S. commodities will help, too.

But increasing buying by Russia and East Europe is an important factor in setting the level of world trade. So global politics will do much to set the outlines of our upcoming export picture.

The coloring of the long-term export scene, too, is a bit uncertain: Argentine government encouragement to native sunflower seed producers, an upswing in olive oil production, a boost in foreign soybean crops, the expected increase in edible grade palm oils and in peanut production—all could easily darken the picture.

▶**Shifts in Home Markets**—In domestic markets there's been a marked shift from inedible to edible uses.

Soap, of course, is the prime example of an inedible use that's lost ground. In 1944, we used about 30 lb. per person; today we use less than 7 lb. per person, for a 1.11 billion lb. total. Syntheic detergents account for about 200 million lb. of fats and oils, but this isn't much compared to the 2 billion-or-so lb. of soap fat replaced.

Drying oils, too, are being replaced by other raw materials. Used chiefly in protective coatings, floor coverings, printing inks and core oils, they are facing stiff competition in every market.

Food uses, on the other hand, are increasing, as mentioned earlier. Even inedible tallow and greases have a growing portion diverted in this direction. In the past two years these fats have been incorporated into animal feeds. The total amount has zoomed from an insignificant figure in 1952-53 to 131

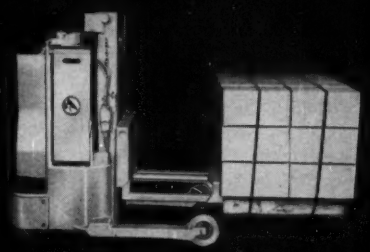
INDEXES
(1935=100)

Business Activity	Nov.	1955	327.2
Chemical Consumption	Sept.	1955	298.9
	Aug.	1955	289.4
	Sept.	1954	254.9

Chemicals by Industry

	Oct. (Prelim.)	Sept. (Rev.)		Oct. (Prelim.)	Sept. (Rev.)
Fertilizer	71.71	60.76	Textiles	10.59	10.53
Pulp & paper	37.07	34.40	Coal products	12.23	12.12
Petroleum refining	29.85	29.19	Leather	4.25	4.21
Iron & steel	19.26	18.13	Explosives	9.95	9.98
Rayon	30.76	30.10	Rubber	7.69	7.30
Glass	27.20	25.28	Plastics	25.15	24.87
Paint & varnish	30.11	32.05	Total	315.82	298.9

New L-S HydraFork with extendible forks



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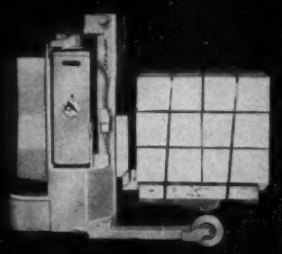

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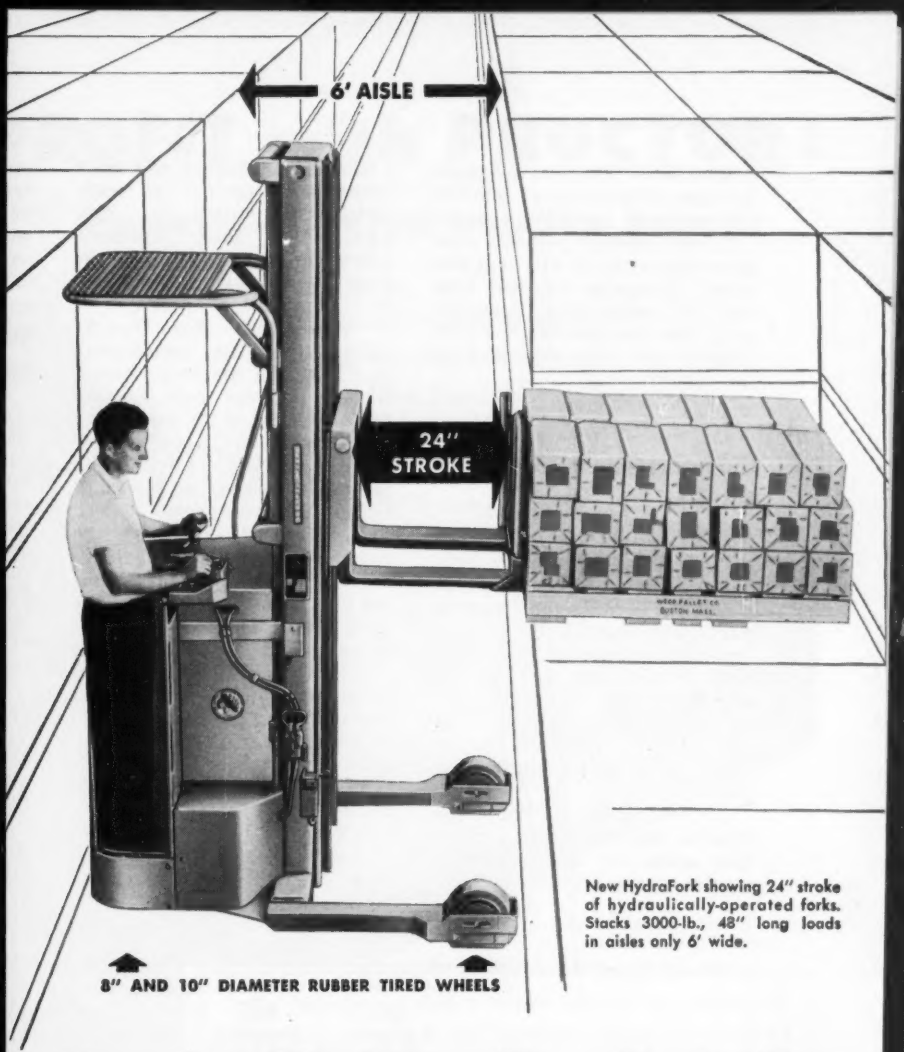
Want maximum floor protection?
Want to use your existing racks and pallets? . . .

You want a HydraFork!



New HydraFork showing 24" stroke of hydraulically-operated forks. Stacks 3000-lb., 48" long loads in aisles only 6' wide.

Gives you Maximum Floor Protection in Minimum (6') Aisles

Here's a narrow-aisle truck that does not straddle loads, consequently it can be equipped with large 10" diameter rubber-tired load wheels that are easy on your floors. To pick up a load, the operator simply positions the truck; extends the hydraulically-operated forks into the pallet; lifts; and retracts load into the truck. No aisle space is wasted for maneuvering when picking up or depositing loads.

And, the HydraFork has all the other exclusive Lewis-Shepard features which have made Lewis-Shepard trucks a symbol of quality across the country: "Lubricated-for-Life" design; Roller Masts, Magnetic Controls, Gear Drive, etc. Get full information on the HydraFork — available in "walkie" or riding types, with capacities to 3,000 lbs. It's the latest addition to the L-S Master Line, the only complete line of materials handling trucks on the market. Send for catalog. Use the coupon below.

RECENT REORDERS PROVE L-S DEPENDABILITY

Listed are typical reorders from blue chip companies in various industries:

Chemical Mfr.	has 52 L-S — reordered 3
Electrical Goods	has 255 L-S — reordered 3
Food Packer	has 70 L-S — reordered 2
Grocery Chain	has 57 L-S — reordered 3
Rubber Goods	has 57 L-S — reordered 4

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"The Master's Line"

Please send catalog on ☐ L-S HydraFork ☐ L-S Master Line Trucks

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Company.....

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million lb. in 1954-55. And since fats are a fine source of calories this use will probably expand.

So even though industry men agree that exports will bear the brunt of surplus disposal now and for some time, research looks like the best bet for permanent and plentiful uses in the future.

Chemical Sales, Production Go Up, Up, Up

More figures are in to show that the chemical industry probably broke just about every one if its own records you'd care to name last year, be it in sales, expenditures, profits, or production. Here's the gist of the Manufacturing Chemist's Association's report just in:

• Sales — $23 billion, up 17.6% over 1954 and the best ever.

• Production — 162 on the Federal Reserve Board production index for the first eight months (base: 1947-49 = 100), a new high. Plastics and resin production reached an estimated 3.5 million lb., 20% higher than 1954. Synthetic fibers hit 1.2 billion lb. in the first nine months of 1955, up 23% over 1954.

• Spending — More than $1 billion, the fifth consecutive year in which America's fourth largest industry has invested this much for plant expansion.

• Profits—$777 million, after taxes, for the first six months, compared to $585 million for the same period in 1954. Cash dividends paid by the chemical and allied products industries were $379 million for the first half, some 16.6% above 1954. (Chemical industry payments added up to 13% of all cash dividends paid by manufacturing industries during the period.) And the chemical and allied product industries will shell out an estimated $1.4 billion in Federal taxes alone in 1955.

• Wages Paid—The chemical industry directly employed more than 810,000, including some 540,000 production workers, said the MCA. Multiply that by average weekly earnings for hourly rated workers of $84.25, and you have a big contribution to consumer buying power.

	1953 Production Gallons	1954 Production Gallons	Increase %
Sweeping compounds (pounds)	68,613,397	73,411,515	7.0
Wax emulsions	8,564,757	9,465,450	10.5
Resin finishes	712,551	773,450	8.5
Liquid floor cleaners and wax strippers	5,279,031	5,495,335	4.0
Floor sealer and gym finishes	1,681,987	1,555,435	−7.5
Solvent-type waxes:			
liquid	442,002	439,510	−1.0
paste (pounds)	2,355,300	2,476,185	5.0
Paste type emulsions (pounds)	232,023	363,803	56.8
Dust mop treatment	426,950	549,544	28.7

Sweeping and Shining Floors: Big Chemical Market

Cleaning, polishing, sweeping compounds — tools for tedious tasks—are nevertheless hungry consumers of chemicals. Their appetite is increasing, according to a nationwide survey just completed, by the Chemical Specialties Manufacturers' Association, of shipments at the manufacturers level.

Production of liquid wax emulsions, resin finishes, liquid floor cleaners and wax strippers, floor sealer and gym finishes, and solvent-type liquid waxes totaled up to 17.7 million gal. in 1954, a 6% increase over 1953. There were also nearly 2.5 million lb. (up 5%) of paste waxes and some 350,000 lb. (up 57%) of paste wax emulsions sold in 1954. Throw in the biggest volume item of all those surveyed—nearly 73.5 million lb. of sweeping compounds, up 7%—and you should be convinced.

Market Meeting Spotlights Aromatics

Next week in Pittsburgh, chemical market research men will sit down to hear four speakers and three panel groups survey a wide range of aromatic chemicals. The occasion: the latest meeting of the Chemical Market Research Association, Jan. 31-Feb. 1, in Pittsburgh's Webster Hall. The chemicals: as specific as *m*-xylene, as general as the aromatics derived from coal tar.

There'll be papers on benzene and phenol—primary sources of supply, primary uses, future growth. Another paper will similarly survey, naphthalene and the three xylenes, with special attention to the effect of demand for one isomer on supply and price of others.

The keynote address will review the whole coal tar industry as an aromatic chemicals source and the factors which influence their availability.

Conventional Fuels—Still Big in the Year 2000

Amid all the predictions as to how atomic energy and solar energy are putting the best of all possible worlds just around the corner comes some sobering advice from one of the atom's adherents. C. V. Roseberry, manager of commercial power activities for Westinghouse, points out that the best industry estimates say that, even in the year 2000, twice as much electric power will be generated by conventional fuels as by nuclear fuels.

This doesn't mean that atomic development will be lagging. For, says Roseberry, ". . . builders of the several nuclear reactors now planned or under construction have set target costs which are not too far from the cost of conventional power in high-fuel-cost-areas." What does prompt the opinion that

(*Continued on p.* 260)

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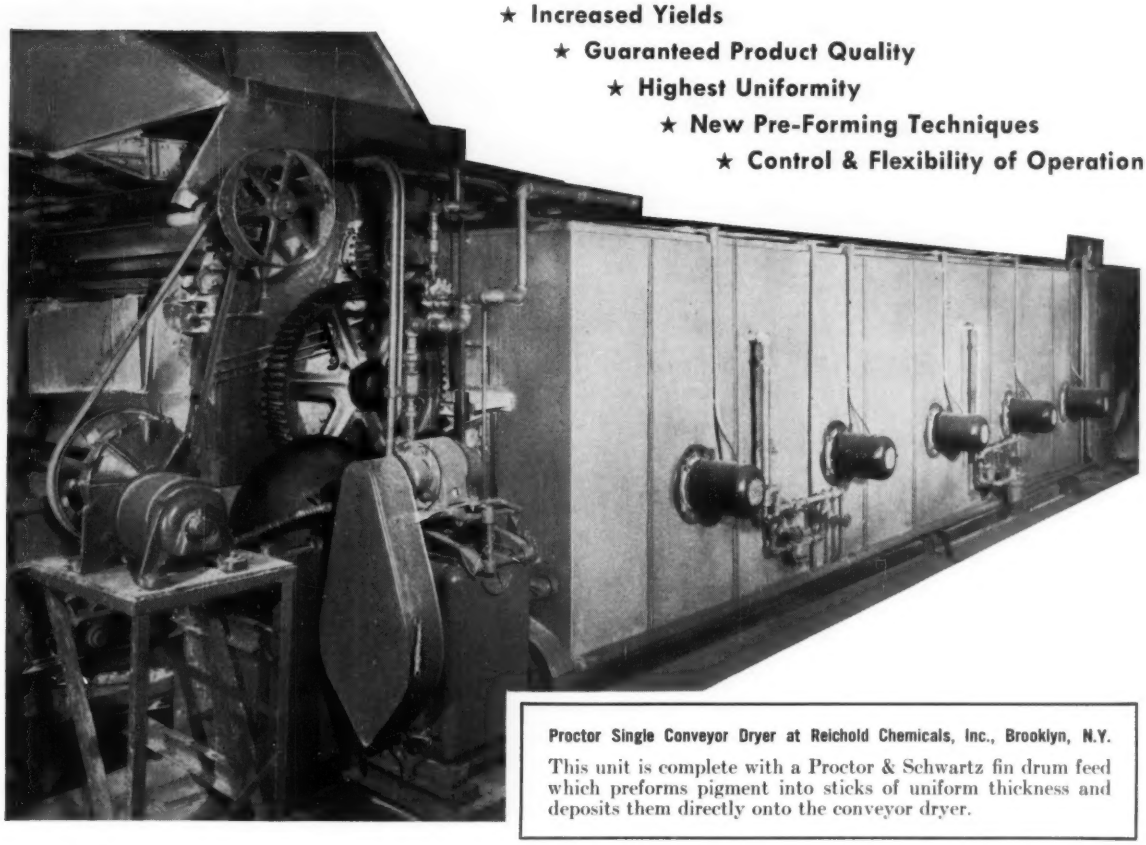

Proctor Single Conveyor Dryer at Reichold Chemicals, Inc., Brooklyn, N.Y.
This unit is complete with a Proctor & Schwartz fin drum feed which preforms pigment into sticks of uniform thickness and deposits them directly onto the conveyor dryer.

Proctor Drying Ranges make possible continuous conveyor drying of many materials formerly dried by batch processing.

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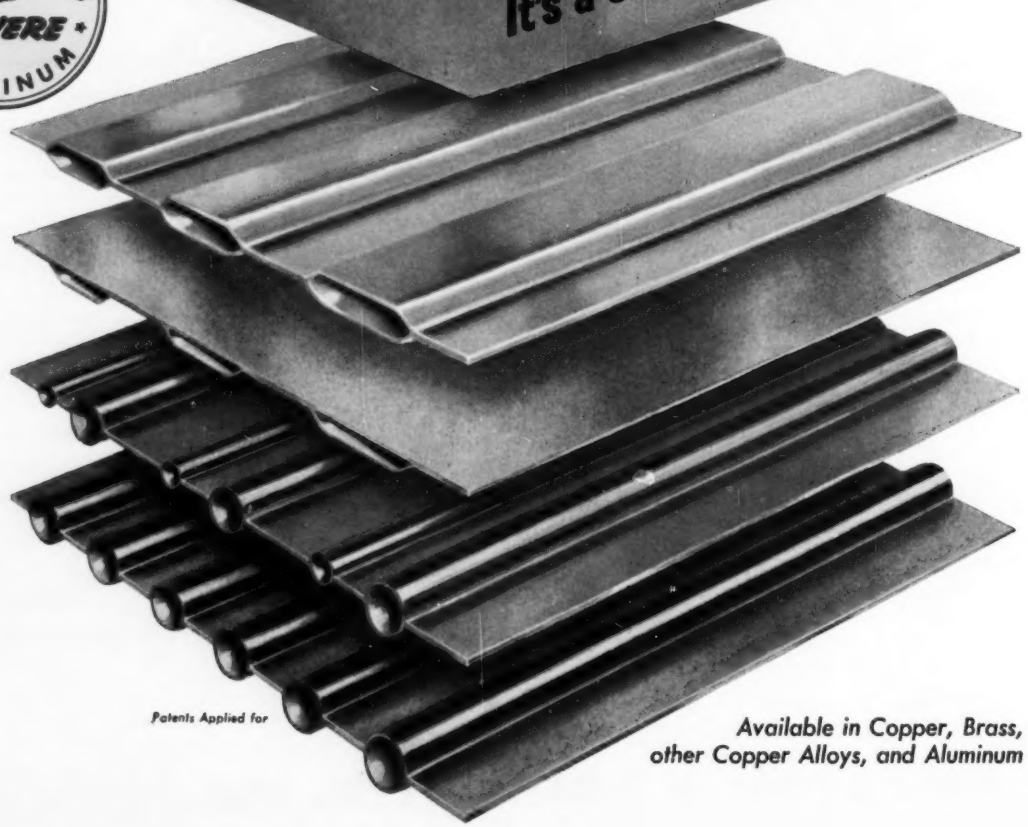


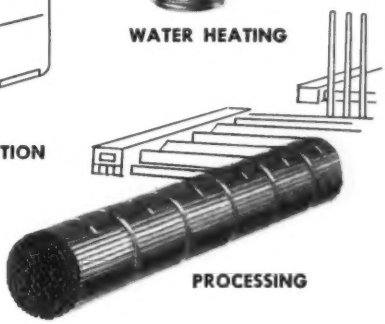
Patents Applied for

Available in Copper, Brass, other Copper Alloys, and Aluminum

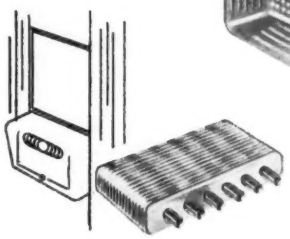
Strip

WATER HEATING

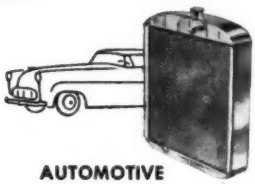
REFRIGERATION



PROCESSING



AIR CONDITIONING



AUTOMOTIVE

Here, for the first time, is a combination of tube and strip that is made from a single piece of metal! No joints! The product of intensive development by Revere's Research and Development Department, which sought and found a brand new way to give American industry tube plus strip that is more economical to buy, more economical to work, stronger and more efficient in performing 1,001 tasks.

Remember Revere Tube-In-Strip is solid, not two strips welded, brazed, or bonded together.

What does this mean to you? You buy strip, fabricate it as you wish, stamping, bending or forming it, and then as a final operation inflation expands the integral channels into tubes. Expanding in the open, the tubes are round; by expanding into dies, the tubes can be made rectangular, fluted, half-round, hexagonal, etc.

METALS: Copper, Brass, other Copper Alloys, Aluminum, many others.

ECONOMY: You save in first cost, and in fabrication. New and improved designs are made possible. The web between the tubes conducts heat faster. The vastly increased structural strength means you can use lighter gauges, saving in weight and in price.

The applications of this radically new, different and superior Revere Product are unlimited. We most proudly present Revere Tube-In-Strip to the designers and manufacturers of American Industry. The Revere Technical Advisory Service and the Research and Development Department will gladly collaborate with you in taking full advantage of this marvelous new material.

SOME OBVIOUS USES

REFRIGERATION
- Condensers
- Evaporators
- Cooling Coils
- Cold Walls

AIR CONDITIONING
- Condensers
- Evaporators

HEAT EXCHANGERS
- Process Industries
- Chemical Industries
- Petroleum Industry

INSTRUMENT LINES

WATER HEATERS AND COOLERS
- Domestic
- Commercial

RADIANT PANEL HEATING

BASEBOARD RADIATORS

AUTOMOTIVE
- Car and Truck Radiators
- Heating and Cooling Panels
- Transmission Oil Coolers

AIRCRAFT

SOLAR HEATING

ELECTRICAL INDUSTRY
- Oil Coolers
- Gas and Fluid Heat Exchangers

AUTOMATION
- Control
- Recording
- Metering

FOOD PROCESSING

BEVERAGE INDUSTRIES

ARCHITECTURE AND BUILDING
- Structural
- Decorative
- Functional

MANY, MANY OTHER APPLICATIONS IN EVERY INDUSTRY

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coal, oil and gas will still have a healthy edge on the atom 40-50 years hence is industry's prodigious appetite for energy which may be doubled in 2000 what it is today. Coal and oil will be plentiful enough for some time to come to be able to generate power more cheaply than can atomic fuels like uranium.

Why the big rush, then, to get nuclear power plants right now, if not sooner? Here's Roseberry's three part answer: Depletion of fossil fuels, with their many uses other than as energy-producing materials, would be tragic; as electricity costs go up, with increasing scarcity of these fuels, our standard of living will suffer; years of work will be necessary before we get the hang of atomic power.

GUIDED TOUR CONTINUED

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Lithium Chemical Boom.

Clever process engineering signalizes the remarkable upsurge in Li chemicals capacity. Here is the story behind Lithium Corp.'s new "acid" process plant at Bessemer City, N. C. (p. 294)

Find it hard to keep up?

Maybe you should keep closer tabs on new reference books coming out. Technical Bookshelf is your monthly guide. (p. 312)

New technical literature!

You can now get—free and fast—literature on any subject in your field. Keep your files up to date the easy way.

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Inside Back Cover

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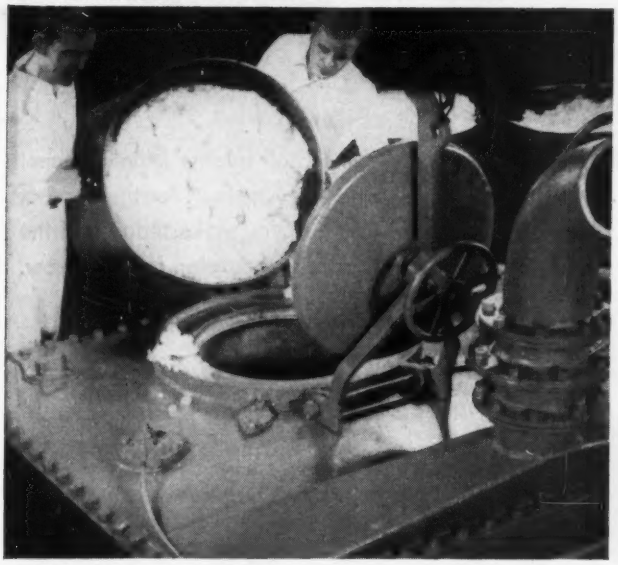
IN PETROLEUM (*Motor Oil and Gasoline Additives*)



IN CHEMICALS (*Plastics*)

Rely on Enjay for top quality in your product, the kind that makes for growing demand and fast-paced selling. The Enjay Company supplies the petroleum, surface coating and chemical industries with a complete line of uniform, high quality petroleum chemicals backed by 36 years of *proved* results. You can also depend on Enjay for leadership in research and for expert technical assistance in developing new or improved products through chemistry. *Next* time, call Enjay for your chemical needs.

IN SURFACE COATINGS (*Paint, Varnish, Lacquer*)

PETROLEUM	SURFACE COATING	CHEMICAL
PARANOX	PETROHOL 91	PETROHOL 91
PARATONE	PETROHOL 95	PETROHOL 95
PARAFLOW	PETROHOL 99	PETROHOL 99
PARAPOID	JAYSOL	JAYSOL
PARADYNE	Secondary Butyl Alcohol	Iso-Octyl Alcohol
PARATAC	Secondary Butyl Acetate	Decyl Alcohol
PETROHOL	Isopropyl Acetate	Denatured Ethyl Alcohol
Methyl Ethyl Ketone	Acetone	Tridecyl Alcohol
Dewaxing Aid	Methyl Ethyl Ketone	Dicyclopentadiene
Ethyl Ether	Dicyclopentadiene	Isoprene
Isopropyl Ether	Ethyl Ether	Butadiene
Reference Fuels	Isopropyl Ether	Ethyl Ether
	Naphthenic Acids	Isopropyl Ether
RUBBER	Iso-Octyl Alcohol	Tetrapropylene
ENJAY BUTYL	Decyl Alcohol	Tripropylene
VISTANEX	Denatured Ethyl Alcohol	Aromatic Tars
		Benzene
		Acetone
		Methyl Ethyl Ketone

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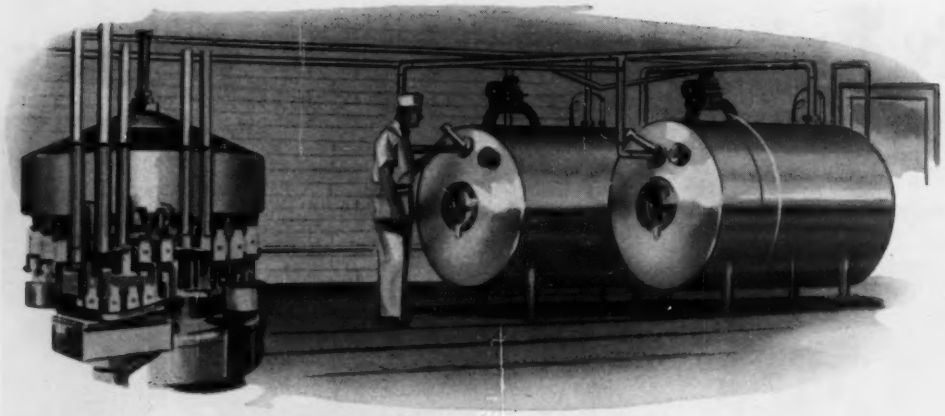
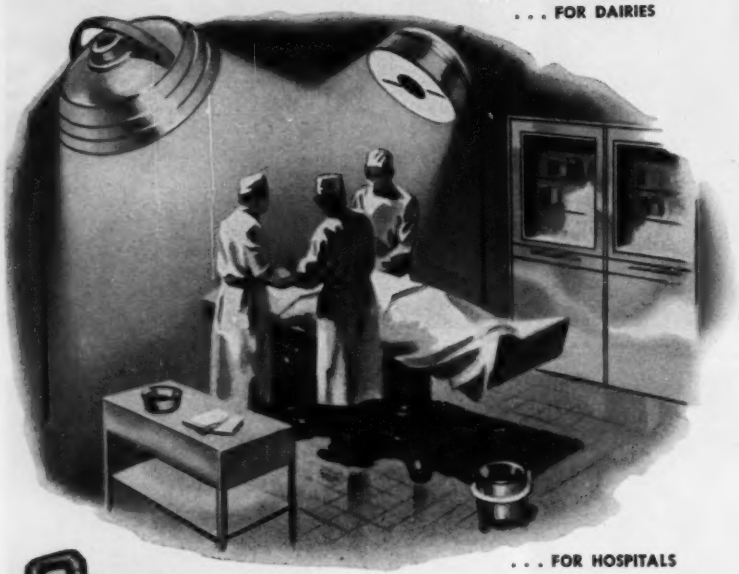


. . . FOR DAIRIES



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High quality stainless sheet and strip steel . . . for the product you make today and the product you plan for tomorrow.

. . . FOR THE CHEMICAL INDUSTRY

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OVERHEARD ON A PLANT INSPECTION TOUR

A short, short story-reading time 53 seconds

Harvey Dale sells—advertising space. He's no production man, but he gets around, picking up facts that help him sell.

Harvey is neither buyer nor seller of production equipment. He's just *interested.* Maybe shop men explain things to him differently because he hasn't got an ax to grind. Or maybe he *hears* things differently because his mind isn't cluttered with product details.

Anyway, he told us about a Simpson Mix-Muller installation he had seen on a recent plant tour: "The Plant Engineer was *crazy* about bottom discharge" he said, adding that his shop friend had explained: "The new Mix-Muller takes up less space, discharges faster and with less 'commotion' than the unit it replaced—because you just open the door and the plows do the work."

You know, the Simpson Mix-Muller has been equipped with bottom discharge for 40 years. And what's more, here's a mixer where the plows and mullers do the work while the heavy crib *and* the pay load remain stationary. It's so basic a fact with us that we think we let Harvey's production friend take it for granted!

If you mix dry or semi solid materials you can't afford to take basic mixing principles for granted either. Why not write for your Handbook on Mulling today? and remember . . .

MIXING IS OUR BUSINESS — OUR PRINCIPAL BUSINESS SINCE 1910.

SIMPSON *MIX-MULLER*® DIVISION

NATIONAL ENGINEERING CO., 636 Machinery Hall Bldg., Chicago 6, Ill.
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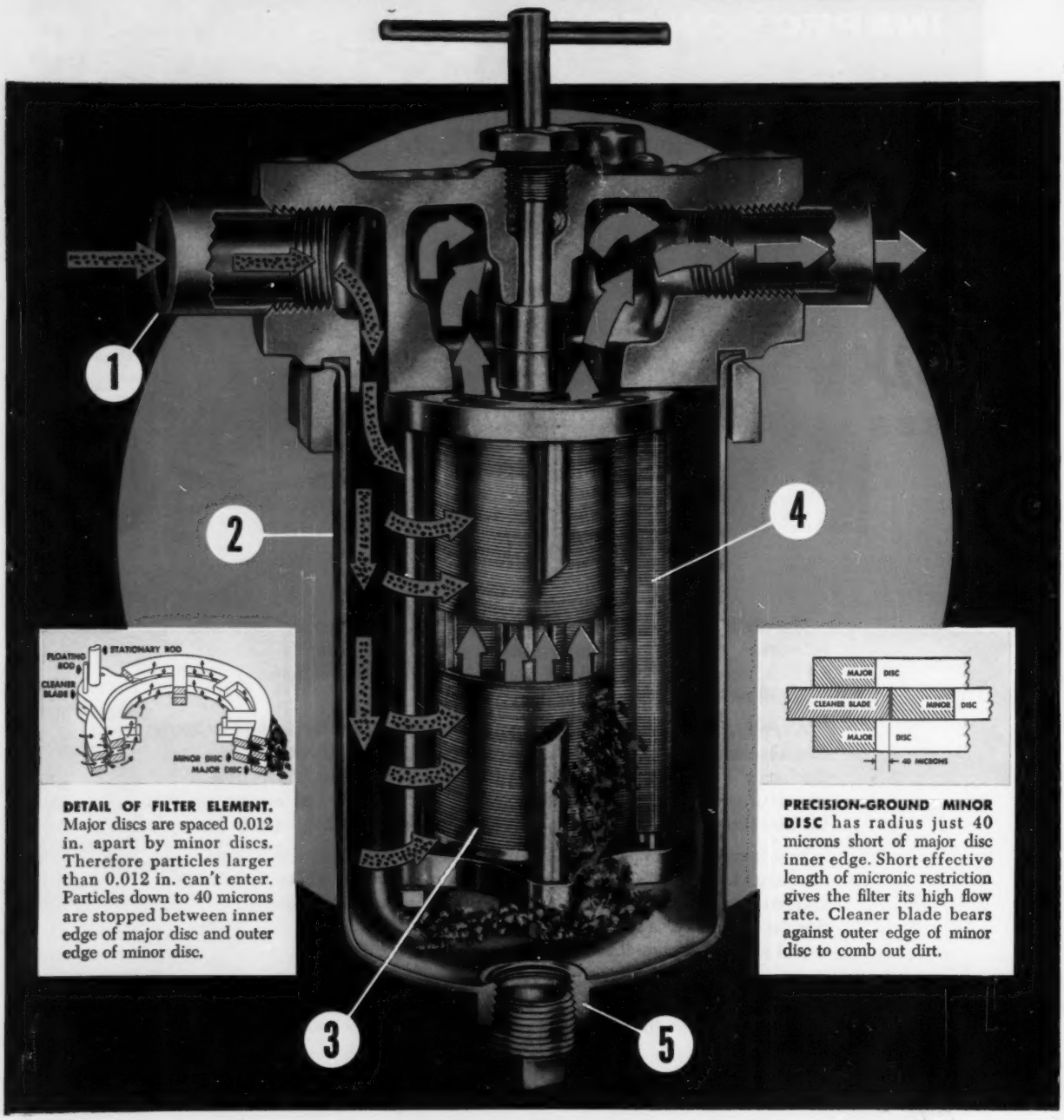
New! CUNO 40-micron



DETAIL OF FILTER ELEMENT. Major discs are spaced 0.012 in. apart by minor discs. Therefore particles larger than 0.012 in. can't enter. Particles down to 40 microns are stopped between inner edge of major disc and outer edge of minor disc.

PRECISION-GROUND MINOR DISC has radius just 40 microns short of major disc inner edge. Short effective length of micronic restriction gives the filter its high flow rate. Cleaner blade bears against outer edge of minor disc to comb out dirt.

CUTAWAY of new SUPER Auto-Klean. Dirty liquid enters inlet (1) at left, fills housing (2) and flows through metal-edge filter (3) of stacked major and minor discs. Trapped dirt is combed out by cleaner blades (4) when discs are rotated and is removed through drain (5). Clean liquid rises through center of filter element, leaves at right.

self-cleaning filter!

The SUPER Auto-Klean

FOR PROCESS LIQUIDS

. . . and you can clean this filter by simply turning the handle!

Many times smaller than other micronic filters of equal capacity, Cuno's new SUPER Auto-Klean filter now makes possible economical, compact, micronic filtration at high flow rates and eliminates the need for replacement cartridges. Here's what SUPER Auto-Klean offers the process industries:

1. Micronic filtration with a self-cleaning filter. Filter can be cleaned continuously with motor drive or intermittently by manually turning handle.

2. Eliminates cartridge changes. Ends operating costs if you've been using cartridge filters.

3. No pressure drop build-up. An 8-in. long, 2¾-in. diameter cartridge handles 30 gpm of liquid at 50 centipoise viscosity with only 3 psi pressure drop—up to 75% more with slightly higher pressure drop.

4. Positive protection against particles larger than 40 microns (actually 0.0015-in.). Filter can't rupture or channel.

5. Much smaller than replaceable-cartridge-type filters of equal capacity, you save on lower initial costs, lower installation costs, lower space requirements than for cartridge units. You get high capacity in a small package.

6. No duplex units needed. Handles full flow all the time with no interruptions for cleaning.

7. SUPER Auto-Klean fits existing Auto-Klean housings. You can easily replace most 2¾-in. diameter cartridges with SUPER Auto-Klean for finer filtration.

8. SUPER Auto-Klean is available in all-steel or type-316-stainless-steel construction with Teflon seal.

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids from More Kinds of Fluids

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge)

FLO-KLEAN (wire-wound) • PORO-KLEAN (porous stainless steel)

Typical SUPER Auto-Klean installations

1. 50 gpm of organic solution, viscosity 100 to 130 cps at 80°C operating temperature and 125 psi operating pressure—40-micron filtration.
2. 1.2 gpm of polyethylene, viscosity 50,000 cps at 340°F, operating pressure of 2,000 psi and pressure drop of 800 to 900 psi—40-micron filtration.
3. 10 gpm of resin, 2,000 SSU at 500°F and 100 psi operating pressure—40 micron filtration.
4. 10 gpm of printing ink—40 micron filtration.
5. 20 gpm of coating liquid—40 micron filtration.
6. Phenolic water at 125 psi operating pressure on pumps—40 micron filtration.
7. 150 gpm of wax—40 micron filtration.

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- ☐ Absorption oils
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- ☐ Alkali
- ☐ Casein
- ☐ Cellulose acetate
- ☐ Chlorinated solvents
- ☐ Cleaning solutions
- ☐ Coal tar solvents
- ☐ Coatings
- ☐ Enamels
- ☐ Ethylene Glycol
- ☐ Ethyl and methyl cellulose
- ☐ Fuel tar
- ☐ Gasoline
- ☐ Glacial acetic acid
- ☐ Grease
- ☐ Industrial alcohols
- ☐ Japan
- ☐ Lacquers
- ☐ Nitrocellulose Solutions
- ☐ Nitrogen
- ☐ Paint
- ☐ Paraffin
- ☐ Petroleum solvents
- ☐ Photographic developing solutions
- ☐ Pickling brines
- ☐ Pyroxylin
- ☐ Resins
- ☐ Rust proofing compounds
- ☐ Sizing
- ☐ Solvents
- ☐ Tar
- ☐ Varnishes
- ☐ Water and water solutions
- ☐ Wax
- ☐ Other _____

CUNO ENGINEERING CORPORATION
3-2 South Vine Street, Meriden, Conn.

Please send me full data on the NEW Cuno SUPER Auto-Klean filter.

Name_____

Firm_____

Position_____

Address_____

City_____ Zone____ State_____

5.8

SMOOTH INSIDE!

Process Lines of Chase® Copper Water Tube *have no shoulders to hinder flow!*

Even heavy industrial fluids like paper pulp flow freely through process lines of Chase Copper Water Tube and Solder-Joint Fittings. There are *no* internal projections to hinder the flow, so pumping costs are kept to a minimum!

You eliminate costly repairs and replacements, too, because Chase Copper Water Tube joined with leak-proof Chase *Solder-Joint* Fittings keeps your system *pressure-tight* for good!

Chase Copper Water Tube is corrosion-resistant, can *never* clog with rust. It comes in long lengths, requires fewer joints, is easy to install. For more information, contact your Chase Wholesaler or Chase warehouse listed below.

Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper (sales office only)

Atlanta	Chicago	Denver	Indianapolis	Minneapolis	Philadelphia
Baltimore	Cincinnati	Detroit	Kansas City, Mo.	Newark	Pittsburgh
Boston	Cleveland	Grand Rapids†	Los Angeles	New Orleans	Providence
Charlotte†	Dallas	Houston	Milwaukee	New York	Rochester†
St. Louis	San Francisco	Seattle	Waterbury		

4 EXCLUSIVE REASONS WHY...

APPLETON vented Explosion-Proof Fixtures are BETTER!

- **"FLAME-TIGHT" CONTACT CHAMBER**
  Exclusive safety chamber prevents explosions even when fixture is serviced with current on! APPLETON *Series AA-51 Vented Explosion-proof Fixtures* offer the positive protection required for hazardous areas.
- **"FULL-CIRCLE" VENTING**
  Porous metal interior and specially designed hood dissipate heat evenly and safely . . . keep fixture temperature down, provide longer lamp life.
- **"INTERCHANGEABLE" UNILET BODY**
  Standardized diameters at top of Dome Unit Assembly permit interchange with AA-51 fixtures of varying wattages.

plus

conversion to different wattages or relamping in just *58 SECONDS!* . . . with no loss of man-hours or lengthy shut-downs. Send for complete information today!

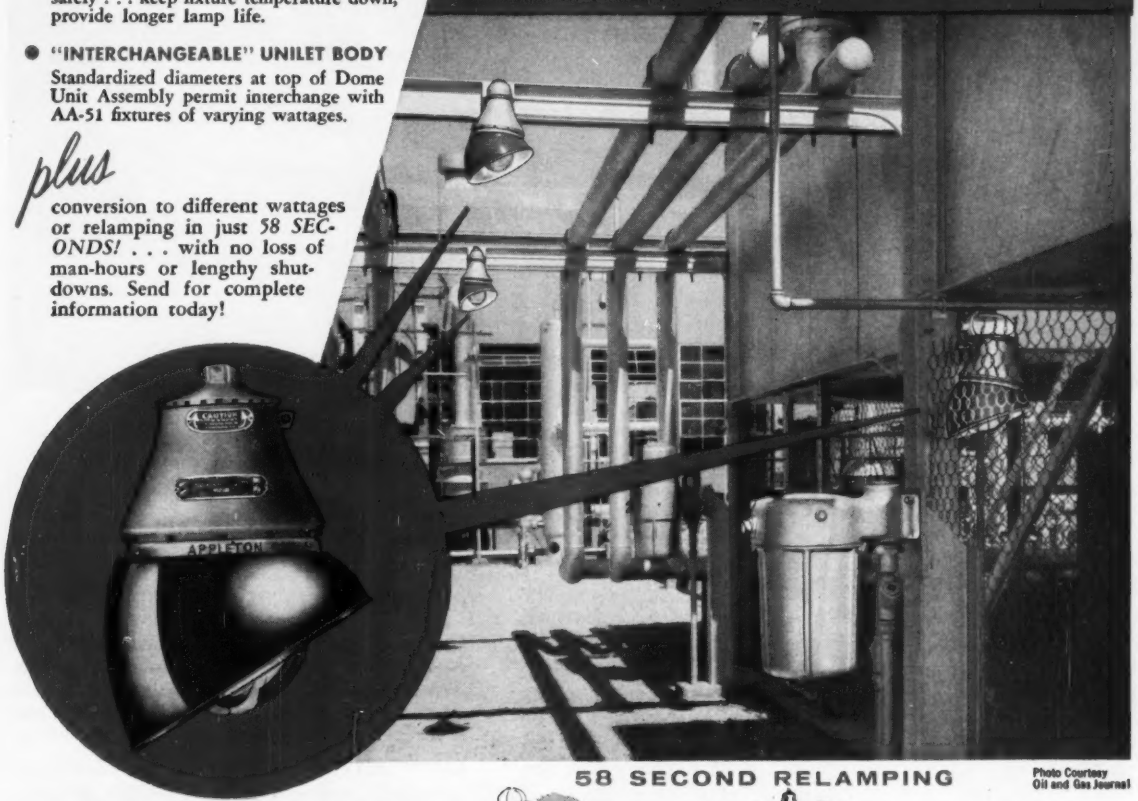


Photo Courtesy Oil and Gas Journal

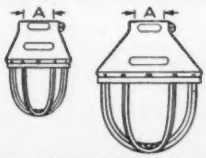
58 SECOND RELAMPING

Series AA-51 stand-by units are ready at an instant's notice for relamping . . . with handles attached in advance.

Only a screw driver is needed to change units . . . and ONLY 58 SECONDS to climb ladder, change unit and descend!

Cleaning fixtures, changing burned out lamps can safely be attended to at bench . . . preventing costly shut-downs.

APPLETON INTERCHANGEABLE UNILET BODY FEATURE



Note how identical diameters "A" on Dome Assemblies allow quick interchange of fixtures with different wattages.

APPLETON ELECTRIC COMPANY
1742 Wellington Avenue • Chicago 13, Illinois

Also Manufacturers of:

Sold Only Through Selected Wholesalers

APPLETON ELECTRIC PRODUCTS

Industrial Lights

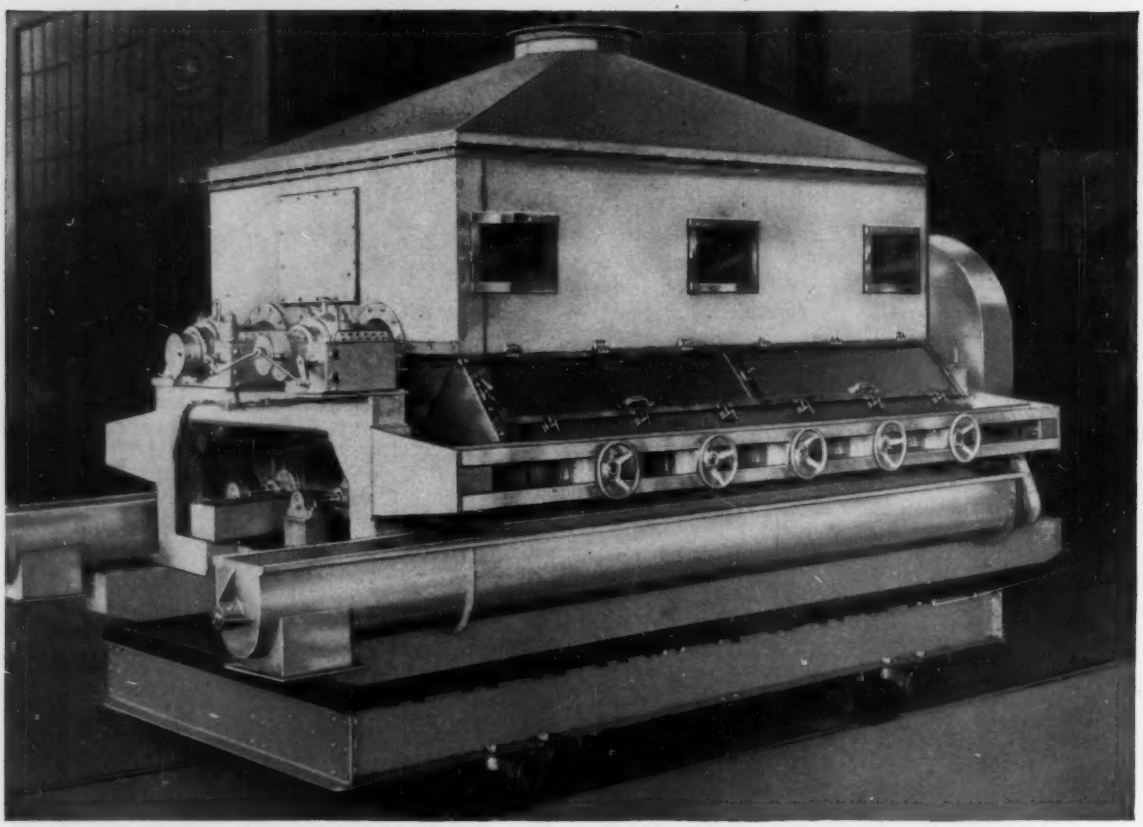
Automatic Reelites

Malleable Iron Unilet Fittings

"ST" Series Connectors

Outlet Boxes

Rely on **APPLETON** *. . . the standard for better wiring*



This Enclosed Double Drum Dryer eliminates hazards of dust, toxicity and fire

Here is the dryer that was designed especially for dry materials that present a dust, a fire, or a toxic hazard. Such materials include dyes, herbicides, and other products that are dusty when dried, or release toxic solvents in processing. The dryer, conveyors and dry material hoppers are completely enclosed, and the casing is connected to the vapor stack. Solvents can be reclaimed by connecting the vapor outlet to a condenser, and dust entrained in the vapor can be recovered by adding a vapor scrubber.

In addition to safety from hazards, this Enclosed Double Drum Dryer offers all the features and economy of drum drying. It is available in a wide range of types, sizes and feeding devices.

It will pay you to investigate these safe, hazard-proof drum dryers for your operations. Why not let us test a pilot plant batch of your hazardous material in our Research and Testing Laboratory? Based on the results obtained, we will make recommendations.

A Complete Process Equipment Service

Dryers of every description constitute but one phase of Blaw-Knox Process Equipment design, engineering and fabrication service for the chemical, food, pharmaceutical, plastic and resin, petroleum, rubber and other industries:

EVAPORATION • DRYING • FLAKING
MIXING • IMPREGNATING • REACTION
VULCANIZING • SOLVENT RECOVERY
CRYSTALLIZATION • EXTRACTION
DISTILLATION • POLYMERIZATION
GAS CLEANING • GAS ABSORPTION
VAPORIZATION • CONDENSATION
STERILIZING • HEAT TRANSFER
LOW AND HIGH PRESSURE PROCESSING

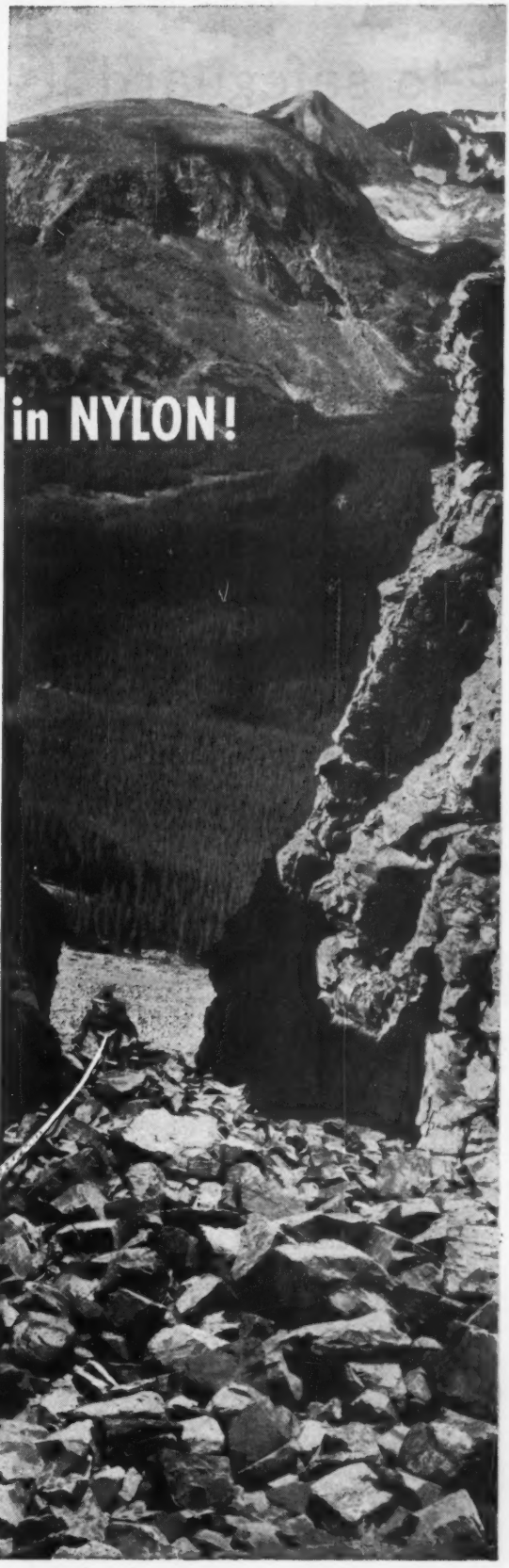
BLAW-KNOX COMPANY
BUFLOVAK EQUIPMENT DIVISION
1551 Fillmore Avenue, Buffalo 11, N. Y.

Makers of process equipment engineered for any temperature, pressure, capacity, reaction

BLAW-KNOX

WILFLEY

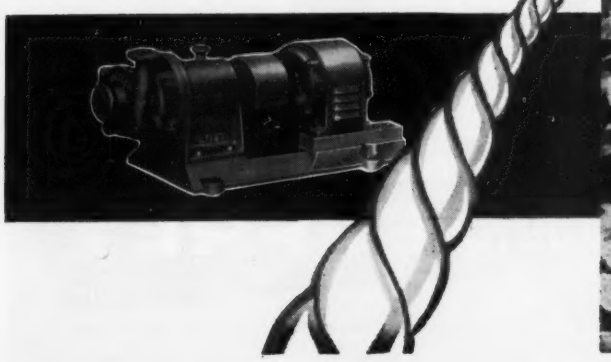
helps put the "muscles" in NYLON!



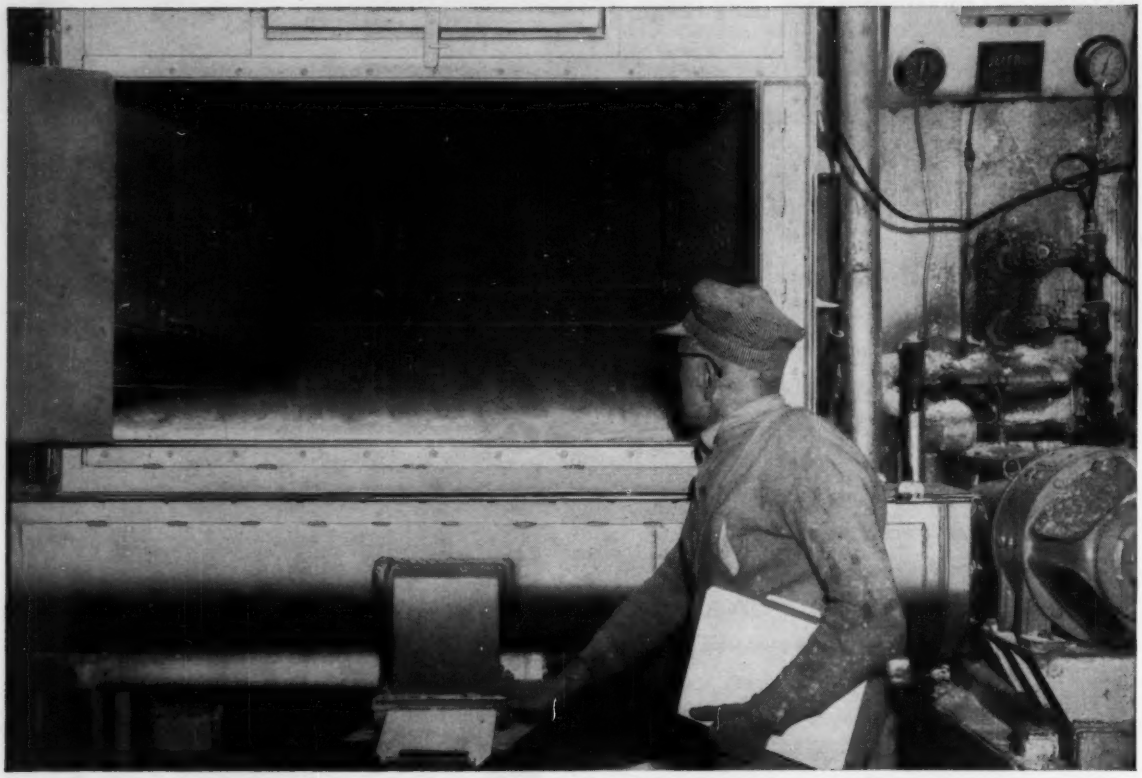
This mountain climber's tough, durable Nylon rope had its beginning in a chemical plant. His reliance on this Nylon "lifeline" matches the complete confidence chemical plant operators have in *Wilfley Acid Pumps*. The handling of Nylon's basic ingredients is one of many Wilfley applications in modern plants throughout the world where these dependable pumps are delivering trouble-free performance on 'round-the-clock schedules. Let Wilfley solve your pumping problems. Individual engineering on every application. Write or wire for complete details.

Wilfley Acid Pump
"COMPANIONS IN ECONOMICAL OPERATION"
Wilfley Sand Pump

A. R. WILFLEY and SONS, INC.
DENVER, COLORADO, U.S.A.
New York Office: 1775 Broadway, New York City



to safeguard its flakes... salt dances on air in **Jeffrey Driers**



Salt actually floats in the air as the Jeffrey vibrating conveyor propels it through the drier, drying it to .02% moisture content.

Salt flakes have the high solubility demanded by butter and other quality food makers. Rotary driers, ordinarily used, tumble the salt and break up these delicate flakes. So Diamond Crystal Salt Co. of St. Clair, Michigan, adopted Jeffrey vibrating conveyor driers for this salt.

Note how the salt actually dances on air as it is gently carried through the Jeffrey drier. Thus its flake form is preserved. Whatever your processing-conveying problem . . . drying, heating, cooling, screening, weighing . . . ask Jeffrey engineers to help solve it. If it's one that vibrating equipment can handle best, or any of the many other Jeffrey conveying methods, Jeffrey will furnish the entire system. Our engineers have a wealth of design and manufacturing know-how on which to draw.

Catalog No. 860 describes Jeffrey conveying equipment. The Jeffrey Manufacturing Company, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

Now

LOWEST COST APPROVED LIGHTING SYSTEM! New Crouse-Hinds Type EVA Fixtures cost less to buy, install and maintain. No special installation or maintenance operations required. No pressure switch to fail and possibly create a hazardous condition. You'll get sustained performance at top economy with these new lighting fixtures. 200 W; with or without guard or reflector; overall length, 13-3/16".

Complete, explosion-proof lighting installations for acetylene & hydrogen areas!

CROUSE-HINDS CONDULETS®

UL Approved for Groups A and B Locations

- The first complete lighting system designed and UL-approved for Class I, Groups A & B, as well as C & D hazardous locations.
- New lighting fixture can be re-lamped even in the presence of combustible gases: gas-tightness not required for its safe performance.
- Heavy, shock-resistant construction withstands pressures from internal explosions without rupturing.
- Flame-tight joints prevent escape of flame to flammable atmosphere.

Whether you're installing a complete explosion-proof lighting system – or merely converting a few of your Group C or D fixtures to these safer Group A's – Crouse-Hinds provides greatest safety and economy. See your Crouse-Hinds distributor, or write us.

Explosion-proof Tumbler Switch Condulets

Explosion-proof Junction Condulets

Explosion-proof Sealing Condulets

Explosion-proof Flexible Couplings

Explosion-proof Condulet Unions

A NATIONWIDE DISTRIBUTION exclusively through ELECTRICAL DISTRIBUTORS

CROUSE-HINDS COMPANY

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CONDULETS • FLOODLIGHTS • TRAFFIC SIGNALS • AIRPORT LIGHTING

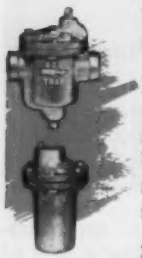
HOW TO FIGURE THE COST OF STEAM TRAPS

STEAM TRAPS are something like wives. First, there is the cost of securing one and installing it in its new home. Then, there is the cost of maintaining it. Now, everyone knows that some wives are frugal and help their husbands a great deal, while others are frivolous spendthrifts. It is the same way with steam traps. You have to figure the original installed cost, the maintenance cost and the effect on general operation.

Divide the total expenses by life of the trap and you get down to the real heart of the matter—the *cost per year.* This is where Armstrong steam traps really shine! Let's take a look at the details:

DIRECT TRAP COSTS

1. First Cost. The price of Armstrong traps is low in terms of capacity. An optimum relationship between leverage, bucket weight, bucket travel and orifice size gives big capacity in a small package. Armstrong steam trap capacity ratings are based on *actual* tests with condensate at steam temperature and with actual hookups. They tell you what the trap will deliver *on the job.* This is not generally the case with other trap ratings.



2. Installation Cost. In four of the most widely used sizes, Armstrong traps are available in either side inlet—side outlet or bottom inlet—top outlet body styles, making possible the simplest, lowest cost installation.

3. Maintenance Cost. 40% less maintenance with Armstrong traps is the average of all the maintenance reduction reports secured from users over a period of years. This is due to high quality of parts, generous safety factors and inverted bucket know-how.

4. Repair Parts Cost. Armstrong heat treated chrome steel valve parts, precision ground and lapped, last a long time. When they do require renewal, a complete new valve mechanism right off the factory production line transforms an old trap into a new one at low cost.

INDIRECT COSTS

1. Cost of Steam Waste. This cost occurs through leaky trap valves, through traps that stick open or lose prime, through extra hours of operating heat transfer equipment due to poor drainage. This is a cost you can eliminate with Armstrongs.

2. Cost of Efficiency Losses. Poor trapping cuts heat transfer efficiency. Figure how much 10% loss affects the return on a $5000 production unit, or a $1,000,000 plant. Armstrong traps discharge condensate and air as fast as it accumulates, keep steam equipment at peak productive efficiency.

3. Cost of Downtime. Armstrong traps stay on the job long and faithfully, eliminating the production losses caused by excessive downtime for maintenance.

A steam trap casts a mighty big shadow that is multiplied by the number of traps in a plant until it has a major effect on operating costs. When you figure the costs from all angles you will find it pays to specify "traps shall be Armstrong."

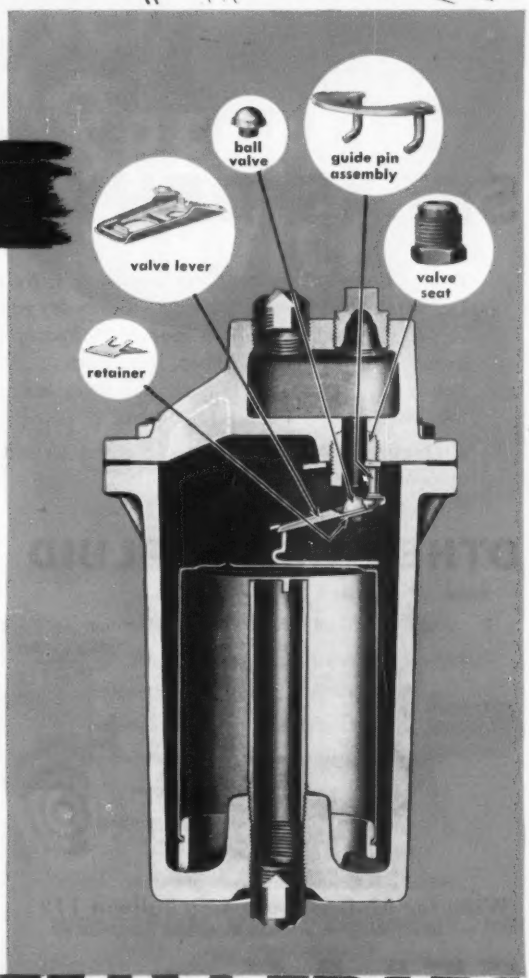
FREE: STEAM TRAP BOOK

—44 pages of prices, design, selection, installation and maintenance data on Armstrong steam traps. You are welcome to a copy. Call your local Armstrong Representative, or write.

ARMSTRONG MACHINE WORKS

858 Maple Street • Three Rivers, Michigan

YOU CANNOT BUY A BETTER TRAP THAN AN ARMSTRONG . . .



Here Are Some Questions for Cost Comparison

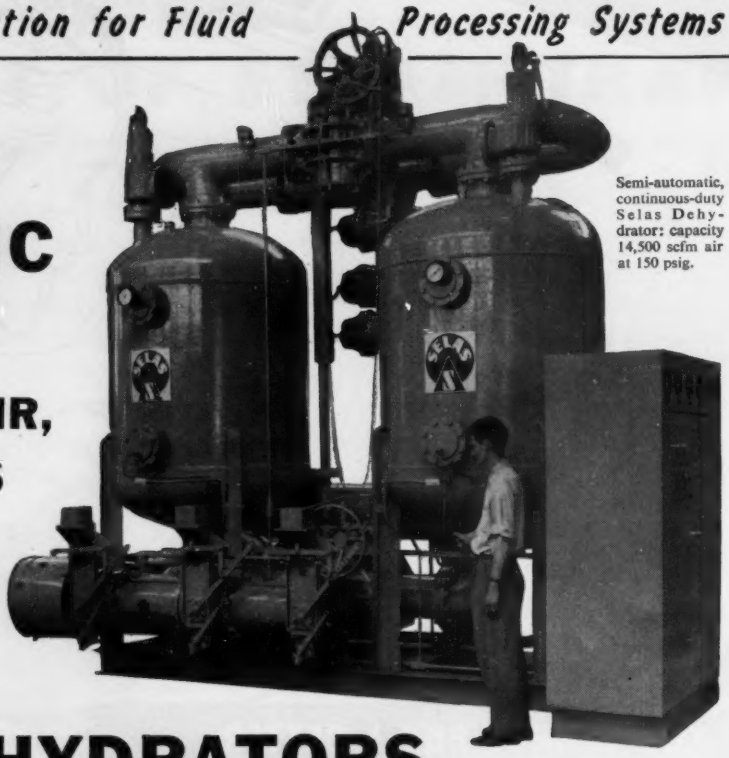
1. Will the valve stay steam-tight for 2 to 3, or even up to 10 years depending on the service?
2. Will the trap discharge condensate at steam temperature to keep equipment hot and minimize non-productive radiation losses?
3. Will the trap automatically discharge air in sufficient volume to keep equipment at peak temperature and to prevent corrosion?
4. Is there enough safety margin of power in the bucket and lever to open the trap when the orifice enlarges slightly due to wear?
5. Can the trap stick in open position?
6. Is the trap apt to lose prime?
7. Are the published trap capacity ratings accurate and reliable for trap selection purposes?
8. Will the trap cleanse itself of ordinary dirt and scale?
9. Is the trap easy to install, inspect and repair?
10. Is the trap unconditionally guaranteed to give complete satisfaction?

If the trap is an Armstrong, the answer to each of these questions is favorable!

ARMSTRONG STEAM TRAPS

Automatic Protection for Fluid Processing Systems

Continuous AUTOMATIC DRYING *of* COMPRESSED AIR, PROCESS GASES *and* LIQUIDS *with* SELAS DEHYDRATORS



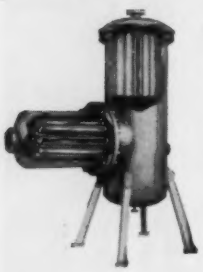
Semi-automatic, continuous-duty Selas Dehydrator: capacity 14,500 scfm air at 150 psig.

Designed for all processing conditions, Selas Dehydrators effectively and economically dry *gases* . . . compressed air, carbon monoxide, hydrogen, oxygen, gaseous hydrocarbons, inert gases . . . and *liquids* . . . propane, butane, kerosene, benzol, toluene, xylene and solvent naphthas.

- Desiccants employed are selected to meet moisture-removal requirements.
- Reactivation by steam, gas or electric heat.
- Operating pressures range from atmospheric to 6000 psig.

Selas Dehydrators are available for manual, semi-automatic and fully automatic operations. Capacities to 15,000 scfm for gases; up to 200 gpm for liquids.

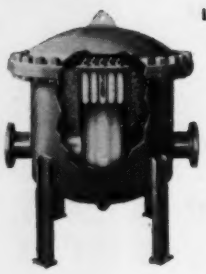
OTHER SELAS FLUID PROCESSING EQUIPMENT



LIQUID-GAS SEPARATION

Liqui-Jector—

Continuous automatic removal of water, water-oil emulsions and dirt from compressed air and process gases (nitrogen, hydrogen, oxygen, fuel gases); condensate oil, dirt and other impurities from steam. Capacities from 10 to 5000 scfm; pressures, 25 to 3500 psi.



LIQUID-GAS SEPARATION . . . PLUS HYDROCARBON VAPOR ADSORPTION

Vape-Sorber—

Continuous removal of hydrocarbon vapors, liquid hydrocarbons, water hydrocarbon emulsions and dirt from compressed air and process gases (nitrogen, hydrogen, carbon dioxide, inert gases). Capacities from 100 to 5000 scfm at inlet pressures up to 3500 psi.

LIQUID-LIQUID SEPARATION

Liquid-Separator—

Continuous separation of emulsions in steam distillations, solvent extractions, organic reactions. Dewatering of solvents and hydrocarbons; recovery of organic liquids. Capacities of single units range from 10 to 6000 gph.

Write for Air-Gas Processing Bulletin 112

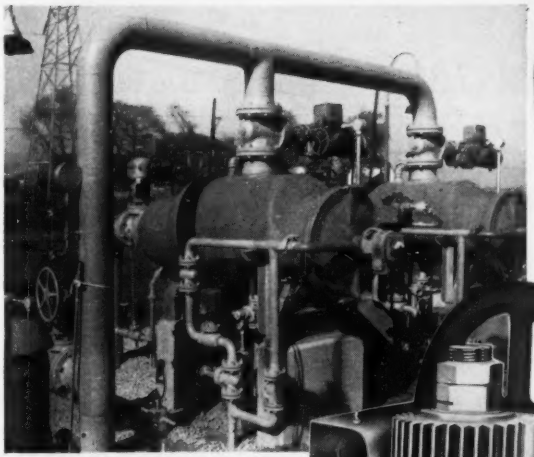
SELAS CORPORATION OF AMERICA DRESHER, PENNSYLVANIA

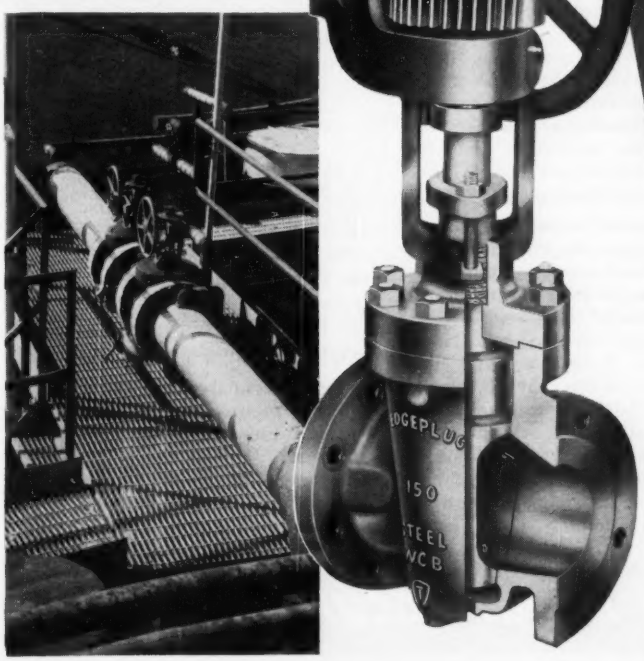
Heat and Fluid Processing Engineers

DEVELOPMENT • DESIGN • CONSTRUCTION

GENERAL SERVICE

SPECIAL SERVICE





WEDGEPLUG
NON-LUBRICATED STEEL PLUG VALVES

The Wedgeplug Principle — by which the non-lubricated plug lifts, turns and re-seats in one operation — assures dependable, trouble-free performance under wide range of temperatures and pressures. Can be furnished wrench-operated, gear-operated, equipped for remote control, or steam jacketed for handling viscous liquids.

Write for Wedgeplug Catalog No. 55-1-W

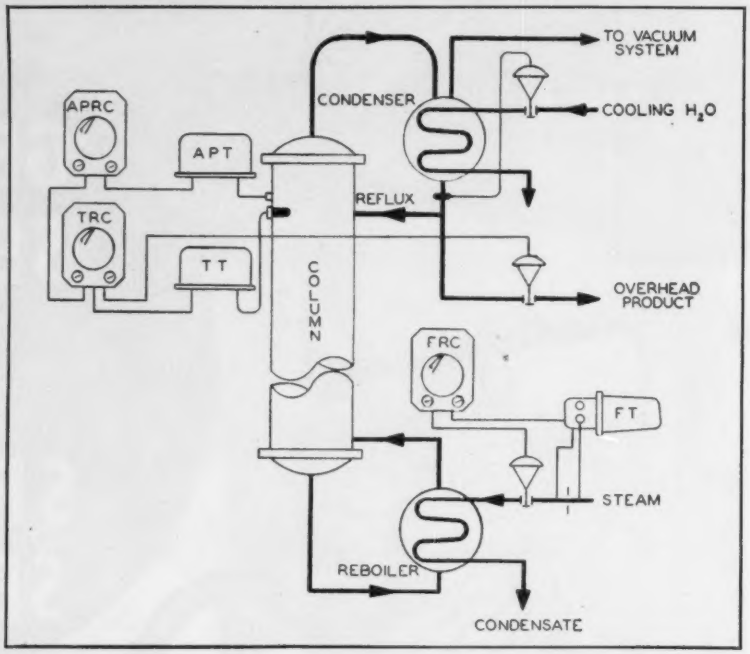
WEDGEPLUG VALVE COMPANY, INC.
NEW ORLEANS 25, LA.
An Affiliate of
STOCKHAM VALVES & FITTINGS
GENERAL OFFICES AND PLANT • BIRMINGHAM 2, ALA.

BATCH DISTILLATION CONTROL

One of a series of basic instrumentation recommendations for the unit operations

GEORGE E. HOWARD, Manager
Application Engineering Dept.

"Unquestionably, our reputation for successful distillation column control is based on broad experience with every type of distillation problem, and a complete line of instruments that meets every need."



PROBLEM

To obtain required separation of components in a batch distillation column in the shortest practical time at the lowest possible cost. This is complicated by the fact that composition of the charge varies continuously, which means that the reflux ratio must be continually adjusted.

SOLUTION

Maintain constant heat input to column reboiler and automatically vary reflux ratio to hold specified overhead composition.

INSTRUMENTATION

Steam flow controller maintains heat input at the value required for optimum vapor velocity as determined by column design. Flow transmitter is located directly at point of measurement for ease of installation and maintenance. Receiver controller gives continuous chart record for evaluating operation and for accounting purposes.

Column Temperature Controller regulates reflux to accurately maintain equilibrium temperature in the column. Since equilibrium temperature is a measure of composition, this is an effective means of holding overhead product at required purity. Precision control depends upon instantaneous detection of column temperature changes hence SPEED-ACT* response in the transmitter is used to overcome inherent measurement lag. Similarly, PRE-ACT* response in the controller gives fast corrective action to overcome inherent lags in processing equipment.

Column Pressure Controller senses absolute pressure changes in the column and automatically adjusts the column temperature controller to compensate for the effect of pressure changes on the equilibrium temperature. A narrow range, barometrically compensated pressure transmitter locally mounted detects the slightest change in column absolute pressure. Chart records on temperature and pressure controllers provide a constant check on column operation and product quality.

Overhead Product Temperature Controller regulates the flow of cooling water to insure complete condensation of overhead vapors. This controller also prevents excessive subcooling of reflux that would result in unnecessary heat load on the column reboiler.

BENEFITS

1. Constant product quality.
2. Minimum operating cost.
3. Continuous record of process operation.
4. Elimination of tedious manual adjustment.
5. Precision control despite process-load changes.

Send for Data Sheet No. 11 for other control recommendations for batch and continuous distillation; or call in your Taylor Field Engineer. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

*Trade Mark

Taylor Instruments **MEAN ACCURACY FIRST**

Dry Bulb °F	RH %
25	73
25	80
140	1.3
140	80
77	14.2
77	80

Kathabar humidity conditioning meets these design specifications in two rooms like the one at left, in laboratories of one of the world's largest chemical companies.

control humidity for testing and processing

Whatever atmospheric humidity you need for testing, Kathabar humidity conditioning has the range of control to meet your requirements. For example, a Kathabar system provides RH from 1.3% to 80% at 140°F in this testing room for chemicals and packaging materials. In another lab, the system delivers air at −82°F without frost, *continuously*.

The basis for this tremendous range is the extreme flexibility of the absorbent medium used in the Kathabar system. Dewpoint depression is independent of temperature. This flexibility has been put to work, with either automatic or manual controls, testing and processing basic chemicals, explosives, film, glue and gelatin, petrochemicals, pharmaceuticals, plastics, rubber, shellac, cereals, coffee, and yeast.

In addition to its flexibility and ease of control, Kathabar humidity conditioning is more economical than overcooling and reheating to produce desired RH. Find out how this system can work for you, *in pilot plant or production line*.

Kathabar®
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

Have humidity conditioning engineer call. ( )

I'd like to know more about Kathabar systems for:

Stopping moisture regain	( )	Testing products	( )
Eliminating condensation	( )	Operating below 32°F.	( )
Drying at low temperatures	( )	Comfort-conditioning space	( )

Desired air conditions: CFM_____; Temperature_____°F; RH_____%.

NAME _____ TITLE _____

COMPANY _____ PRODUCT _____

ADDRESS _____

Get free help on your humidity control problems

FOAMGLAS®

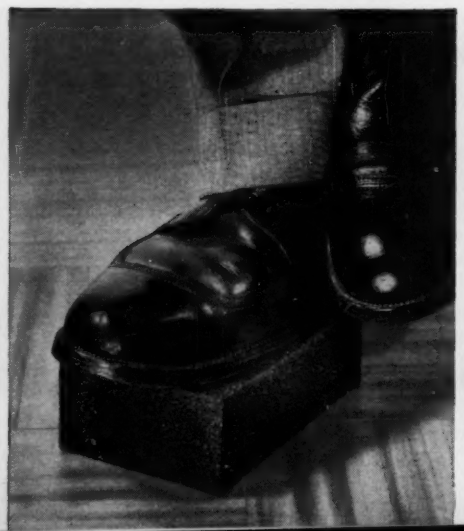
the cellular, stay-dry insulation

STAYS DRY—Cut a piece from your sample. Place it in water. Note how the hermetically-sealed glass cells filled with dead air keep it afloat. Weight it down for days, weeks or longer if you like. Remove the weight and it bobs back to the surface . . . proof that the sealed cells have absorbed no water, still have their original insulating efficiency.

VAPOR-PROOF — With a nail file, cut a ¼" thick slice from your sample. Hold it to your lips and try to blow smoke through it. The smoke won't penetrate . . . proof that FOAMGLAS is a positive vapor barrier in itself.

STRONG AND RIGID — Place your FOAMGLAS block on the floor. Stand on it. Note how it supports your weight without crushing. Compressive strength is over seven tons per square foot . . . making it ideal for load bearing applications.

WON'T BURN — Hold a flame to your sample. You'll see at once that it does not burn . . . an important safety feature in all construction. It's even acid-proof and rodent-proof as you can prove if you happen to have a vial of acid or a pet rat handy.



Send for a sample and make these simple tests!

Prove to yourself that FOAMGLAS is your ideal insulation!

Let us send you a free sample of FOAMGLAS. Use it to make the few simple tests illustrated. You'll prove that this unique cellular glass insulation has exactly the right combination of properties to assure you of these vital benefits: constant insulating efficiency . . . long, maintenance-free life . . . strength and rigidity for a variety of structural applications . . . ease of handling and installation.

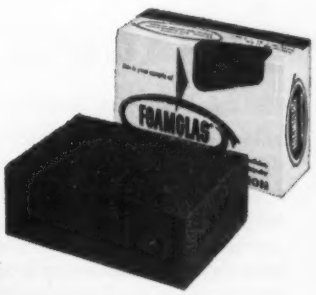
Thousands of actual users have proved in actual performance the benefits so clearly demonstrated by these tests. No wonder, then, that new users every day are picking FOAMGLAS to insulate the roofs, ceilings, walls and floors of all types of buildings, low temperature spaces, piping and equipment. Send for a sample today and make your own tests. Use the handy coupon, or write . . .

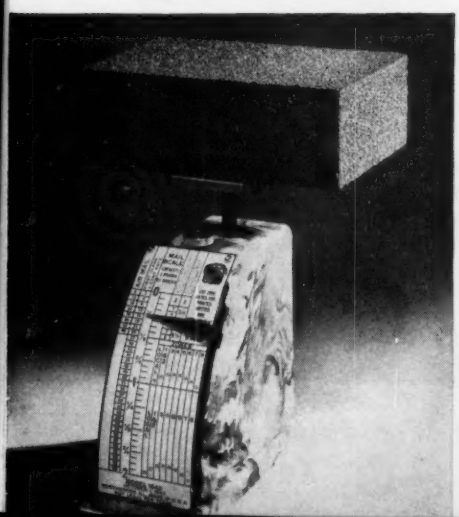
Pittsburgh Corning Corporation

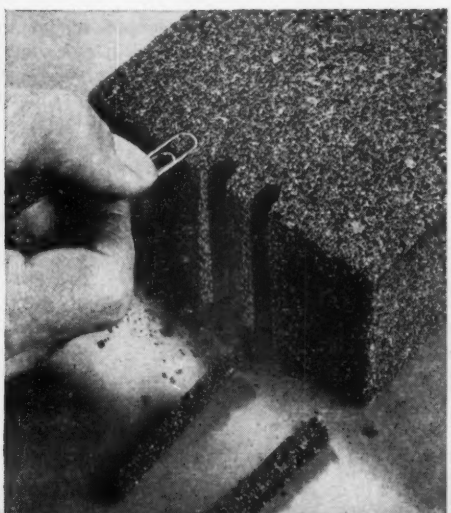
Department H-26, One Gateway Center
Pittsburgh 22, Pa.
In Canada: 57 Bloor Street West, Toronto, Ontario

LIGHT WEIGHT — Just pick up your sample to see how light and easy to handle it is. Check actual weight on your company's postal scale if you wish. The density of FOAMGLAS is only 9 pounds per cubic foot.

EASY TO SHAPE AND CUT—Shave some strips off your sample with an ordinary paper clip . . . workmen use knives, saws or trowels for quick shaping and fitting on the job.







Pittsburgh Corning Corporation
Dept. H-26, One Gateway Center
Pittsburgh 22, Pennsylvania
In Canada: 57 Bloor St. W., Toronto, Ontario

Please send me a sample of FOAMGLAS for testing.

Name_____

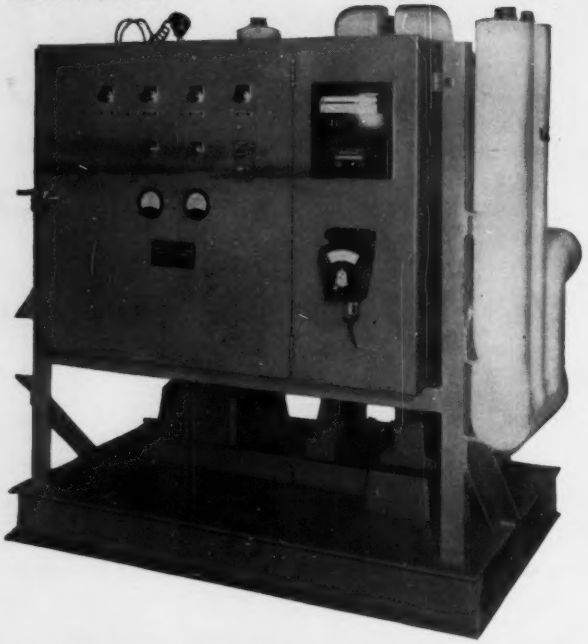
Company_____ Title_____

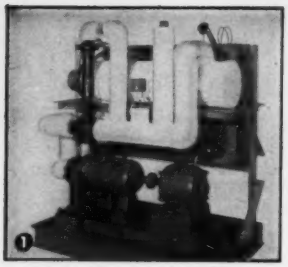
Address_____

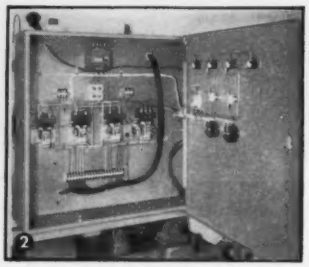
City_____ Zone___ State_____

A COMPLETE TRANSFER OIL HEATING SYSTEM in one compact "PACKAGE"

Instruments and controls are substantially flush mounted. Temperature controls are carefully selected to maintain oil supply temperature within ±2° F. Signal lights confirm satisfactory operation.







1. The system is compactly arranged to conserve space. To obviate leaks, pipe connections are welded wherever possible. The heavy pipe insulation is securely wired and wrapped with cemented canvas.

2. The workmanlike electrical system provides easy-to-trace circuits. All wire of high current capacity is heavy cross section.

WHITLOCK has developed a standard "package", with ratings of 10 to 50 KW, which includes heater operating controls and expansion tank to heat chemically stable transfer oils. Since these oils are liquid over considerable temperature ranges, they are being used increasingly in chemical processing operations. The heating equipment, previously of special design, is now available as a complete, standardized unit to which only oil and electrical connections need be made in order to permit immediate operation.

The combination of low liquid pressures and high liquid temperatures eliminates the need for the application of high pressure design techniques to many current processes. This new "package" effectively serves to reduce overall equipment costs and to simplify process design.

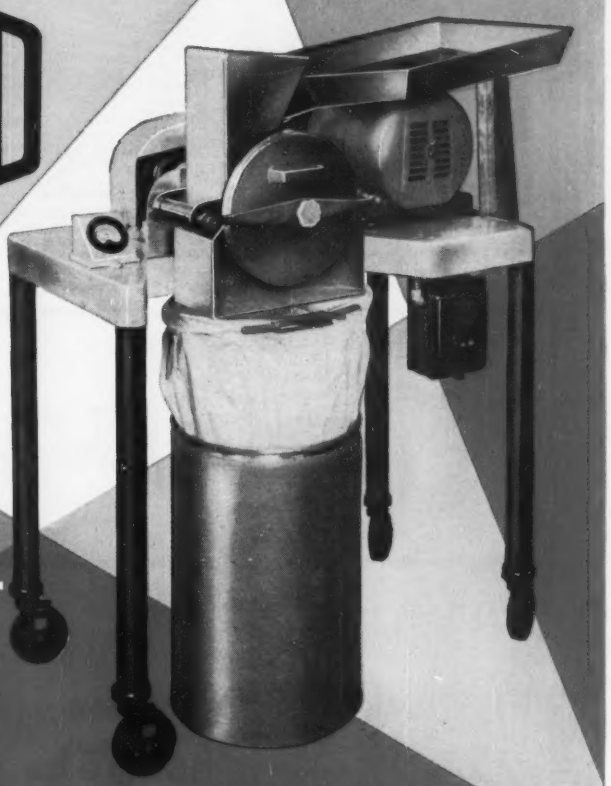
For additional information and prices, write The Whitlock Manufacturing Company, 94 South Street, West Hartford 10, Conn. In Canada: Darling Brothers, Ltd., Montreal.

Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

Presenting the

Mikro-Multi-D



A New Multi-Grind Pulverizer Designed to Insure Product Purity

SEND FOR—your copy of new MIKRO-Multi-D Bulletin and Test Grinding Data Sheet.

The new MIKRO-Multi-D Pulverizer has been especially designed for any processing system in which purity of the product is of prime importance.

This new unit, which provides precise particle control in the 4 to 20 mesh range, is light, yet durable. It is easily assembled and disassembled, permitting quick changes from one product to another with complete freedom from spoilage or contamination. It can also be readily adjusted for speedy changes in particle sizing.

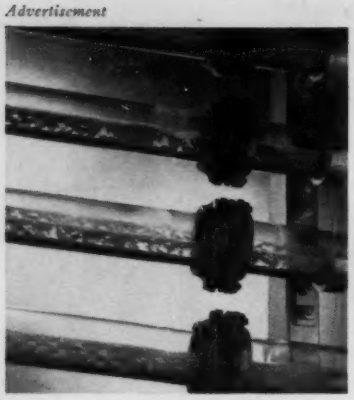
Its ease of thorough cleaning and reassembly makes the MIKRO-Multi-D ideal as a utility unit for many industries, but particularly in the food and drug fields. A test on your own product in the MIKRO Laboratory may provide a solution to your grinding problems.

Mikro-D

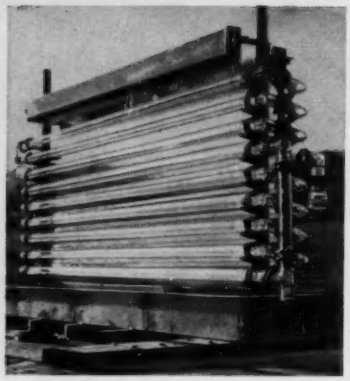
PULVERIZING MACHINERY DIVISION
METALS DISINTEGRATING COMPANY, INC.
55 CHATHAM ROAD SUMMIT, NEW JERSEY

PULVERIZING • AIR CONVEYING • DUST COLLECTING EQUIPMENT

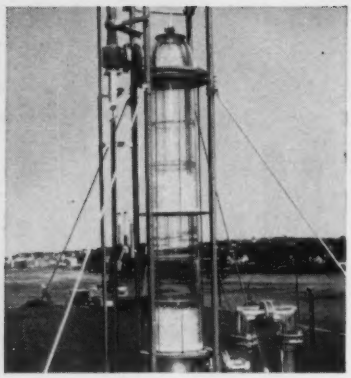
Advertisement



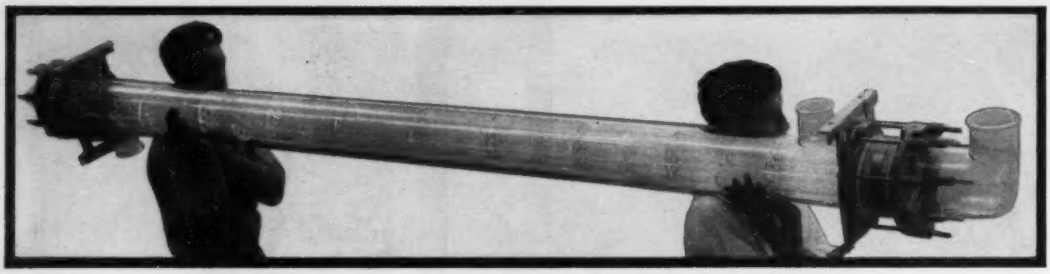
PYREX brand glass pipe lets you transport corrosive and sensitive fluids *safely*.



PYREX brand glass cascade heat exchanger—an extremely versatile unit.



PYREX brand glass fractionating column lets you see fluids in process.



PYREX brand shell and tube heat exchanger—fluids contact only PYREX brand glass No. 7740, chemically resistant ceramic and Teflon. You get complete, low-cost corrosion protection.

PYREX brand glass processing equipment

to help you stop corrosion

Where you handle corrosive fluids or fluids sensitive to metallic contamination, you can have complete processing safety with this PYREX brand equipment.

You can use glass equipment for all acidic solutions and acids except hydrofluoric. Your fluids are safe in chemically stable glass because glass will not take from or add to them.

Because it's transparent, glass lets you see product in flow and check its condition at any point. With glass equipment, you save on cleaning because you clean in place, quickly. Initial costs and costs of upkeep are low.

To get additional information on this equipment and to find specifically how you can save money and improve processes, contact the distributor near you or write, wire or phone Corning.

PYREX brand glass pipe

Noncorroding and nonclogging PYREX brand glass pipe comes in I.D.'s from 1" to 6" and in any length up to 10', with fittings for even the most complex layout. Your own men can install it.

PYREX brand cascade heat exchanger

Thin-walled, highly efficient . . . offers you extreme corrosion resistance and low cost per b.t.u. transferred. Uses low-cost river or sea water for coolant. Mount on floors, walls, ceilings, roofs.

PYREX brand glass fractionating columns

See fluids in process. Supplied in 4", 6", 12", 18" and 23½" diameter sizes with any number of plates. For laboratory, pilot plant or production requirements.

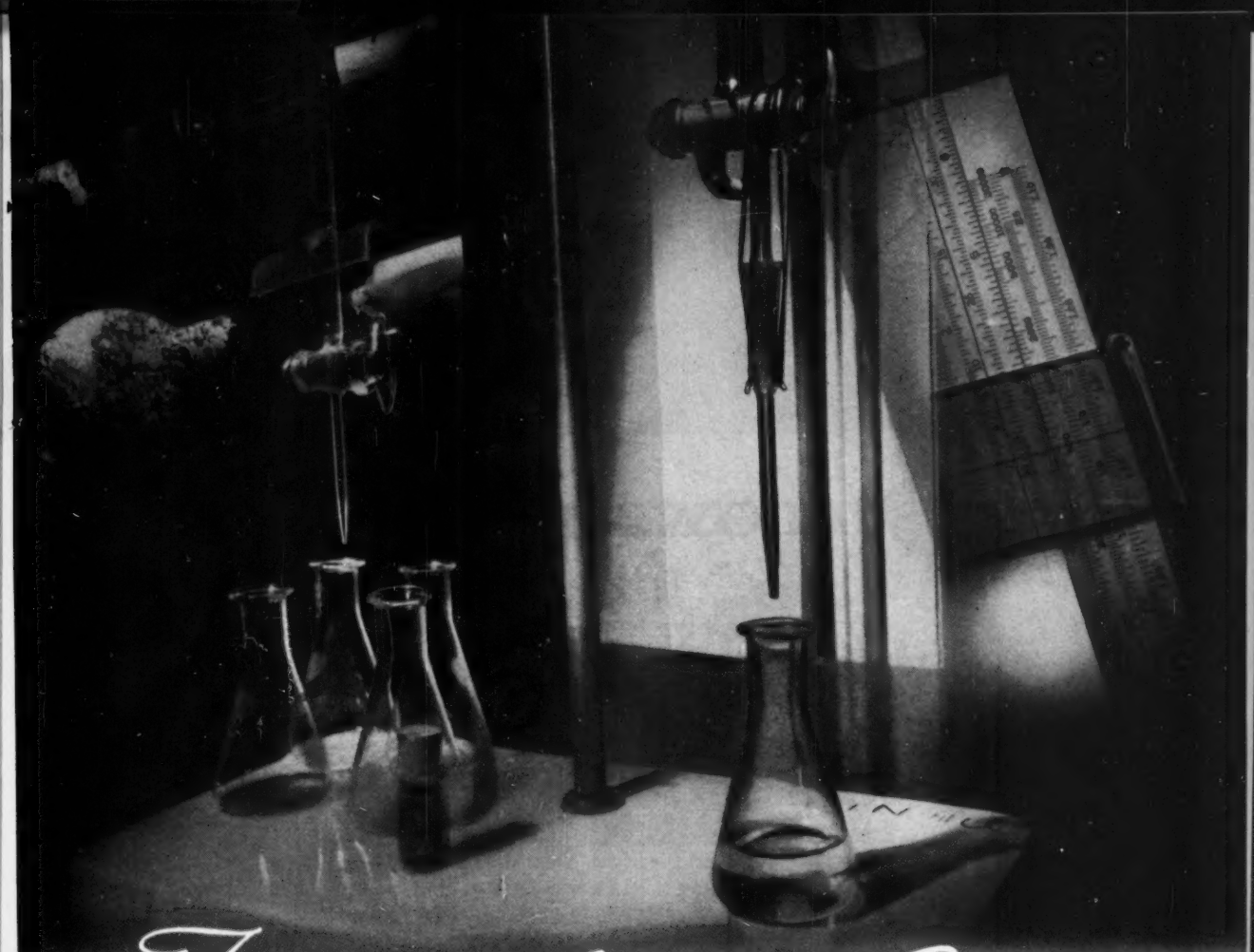
PYREX brand shell and tube heat exchanger

Gives you complete corrosion protection. Has no internally exposed metallic parts—fluids contact only PYREX brand glass No. 7740, chemically resistant ceramic and Teflon. Maintains freedom from deposits for lasting high efficiency. In 50 sq. ft. and 13 sq. ft. sizes.

CORNING'S COMPLETE LINE OF GLASS PROCESSING EQUIPMENT

- ✓ PYREX brand "Double-Tough" Glass Pipe and Fittings
- ✓ Heat Exchangers
  - Shell & Tube (Modular)
  - Cascade Coolers
  - Jacketed
- ✓ PYREX brand Armored Pipe
- ✓ Corning PVC Pipe and Fittings
- ✓ Fractionating Columns
- ✓ Special Equipment

CORNING GLASS WORKS, CORNING, N. Y.
12 Crystal Street
Corning means research in Glass



For Catalysts—Chemicals of Precision

The supreme test of a catalyst is uniform performance. In all cases it is essential that the ingredient chemicals used for catalysts be manufactured to rigid, uncompromising and permanent standards of uniformity.

For many years J. T. Baker Chemical Co. has supplied chemicals for the production of catalysts for use by the plastics, synthetic rubber, vegetable oil and fat, petroleum and natural gas industries, and for use by producers of basic organic and inorganic chemicals.

To protect the interests of the customer, many of these Baker chemicals are made on a confidential basis. Many are even code-numbered for customer protection. But all have in common one thing so important to the manufacturer who makes a catalyst—uncompromising uniformity. In day-by-day and lot-by-lot analyses, Baker Chemicals meet the supreme test.

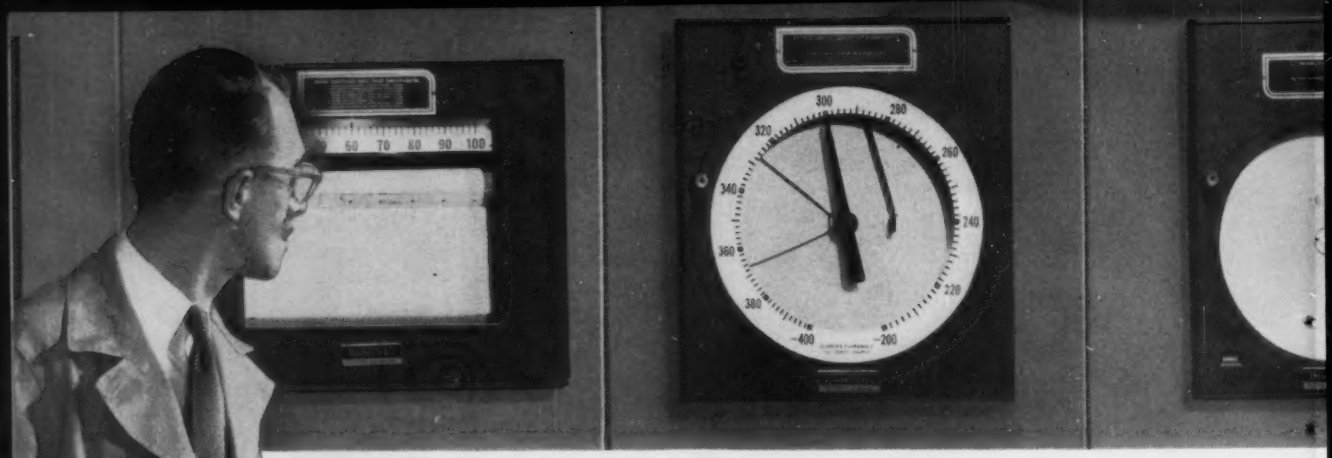
If you need chemicals for catalysis, or for any application where predetermined standards of uniformity are required, J. T. Baker Chemical Co. invites you to discuss your problem with them in confidence.

J. T. Baker Chemical Co., *Executive Offices and Plant:* Phillipsburg, New Jersey. *Branch Offices:* New York, Chicago, Philadelphia, Los Angeles, Toronto.

Baker CHEMICAL

Baker Chemicals

REAGENT · FINE · INDUSTRIAL



LOW TEMPERATURES
(down to -300°F.)
now possible with Trane

For temperatures as low as —300°F. in nitrogen production and hydrogen purification processes, TRANE Brazed Aluminum Heat Exchangers have proved themselves a flexible, *economical* solution to difficult heat exchange problems.

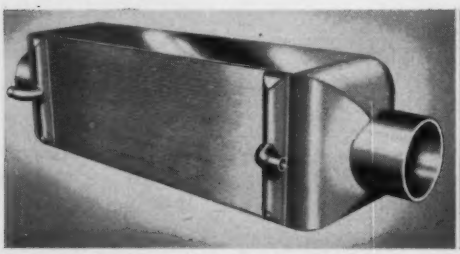
And these TRANE Heat Exchangers are cutting costs, effecting operating economies in two important ways . . .

Initial costs are lower! TRANE Brazed Aluminum surfaces are efficient, flexible . . . make it possible to handle multiple streams in a *single unit*. Installation costs are lower, too, because the compact, lightweight units pack up to 450 feet of heat transfer surface into a single cubic foot.

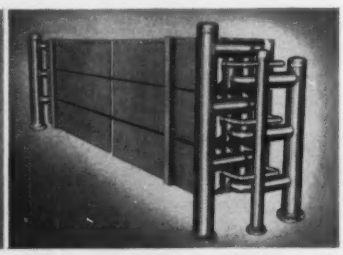
Operating costs are lower! TRANE Brazed Aluminum Heat Exchangers perform efficiently and economically at lowest temperatures. Even when large heat transfer duties are involved, they provide temperature approaches of 5° F. or closer — economically! You use less refrigeration to bring a specified liquid or gas to the desired temperature.

Many of today's most modern air separation and ammonia plants rely on these efficient TRANE Brazed Aluminum Heat Exchangers for cutting costs . . . maintaining highest processing standards!

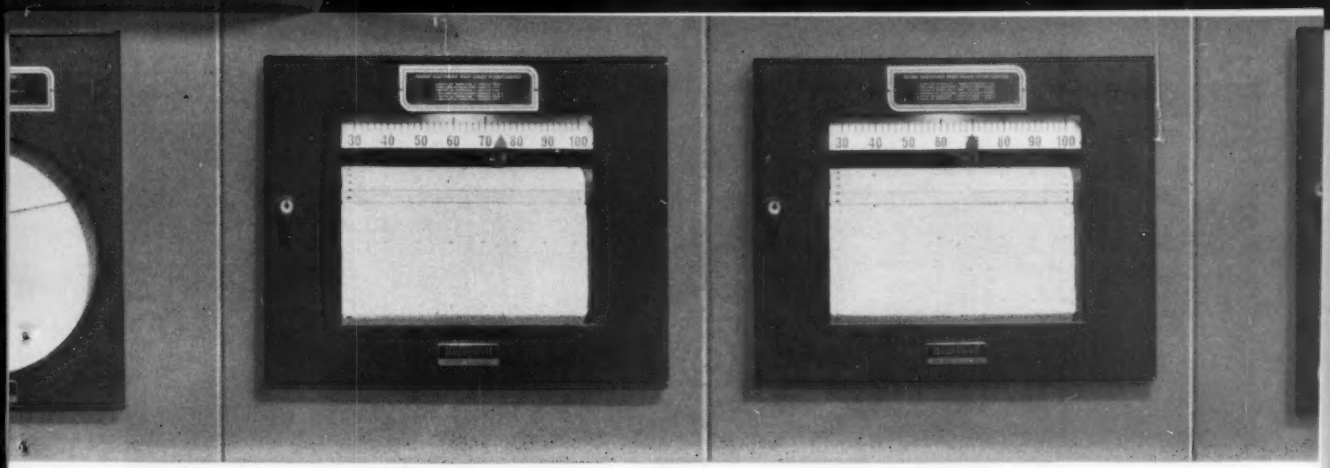
If you have a heat transfer problem that involves low temperatures, multi-stream exchange or close approaches, turn to TRANE! Thirty years' experience in every phase of heat transfer is at your disposal . . . with a TRANE Engineer as close as your telephone! 90 offices in principal U.S. cities and 17 offices in Canada.



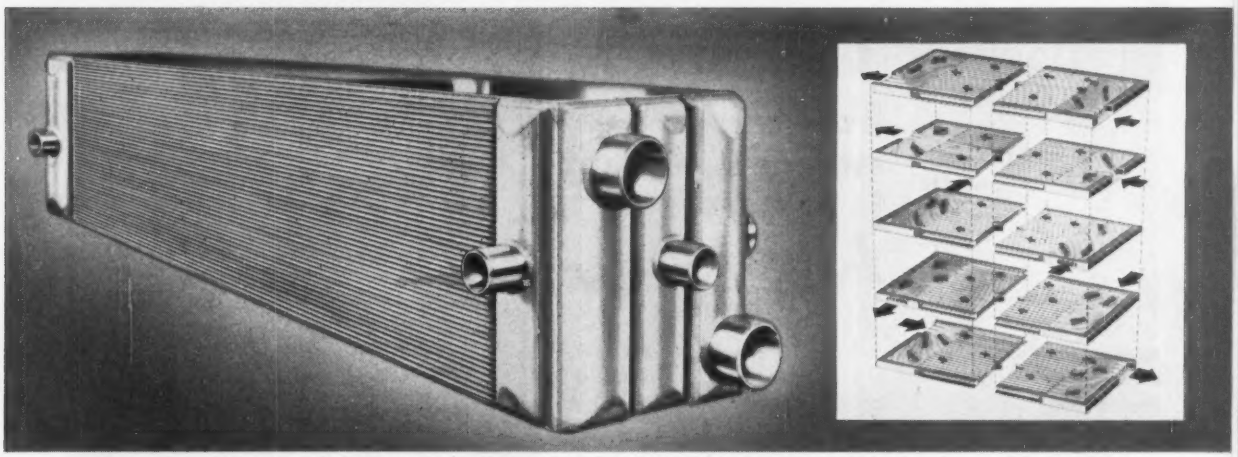
For liquid-to-gas applications, the fins and passages are specially constructed to handle gas and liquids. If you have a heat transfer problem involving low temperatures, multi-stream exchange or close approaches, turn to TRANE for the right equipment!



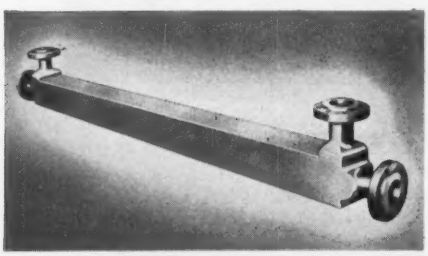
Most process plant applications will require multiple cores, welded together into one unit. Typical brazed aluminum battery assembly shown above has all aluminum manifolding.



with CLOSE APPROACHES
(5°F. or better)
Brazed Aluminum Heat Exchangers



TRANE Brazed Aluminum Heat Exchanger, headered for 5-stream operation. Inset symbolic drawing shows how this TRANE Heat Exchanger can handle as many as five fluids simultaneously. Units are available for cross-flow and counter-flow operation.



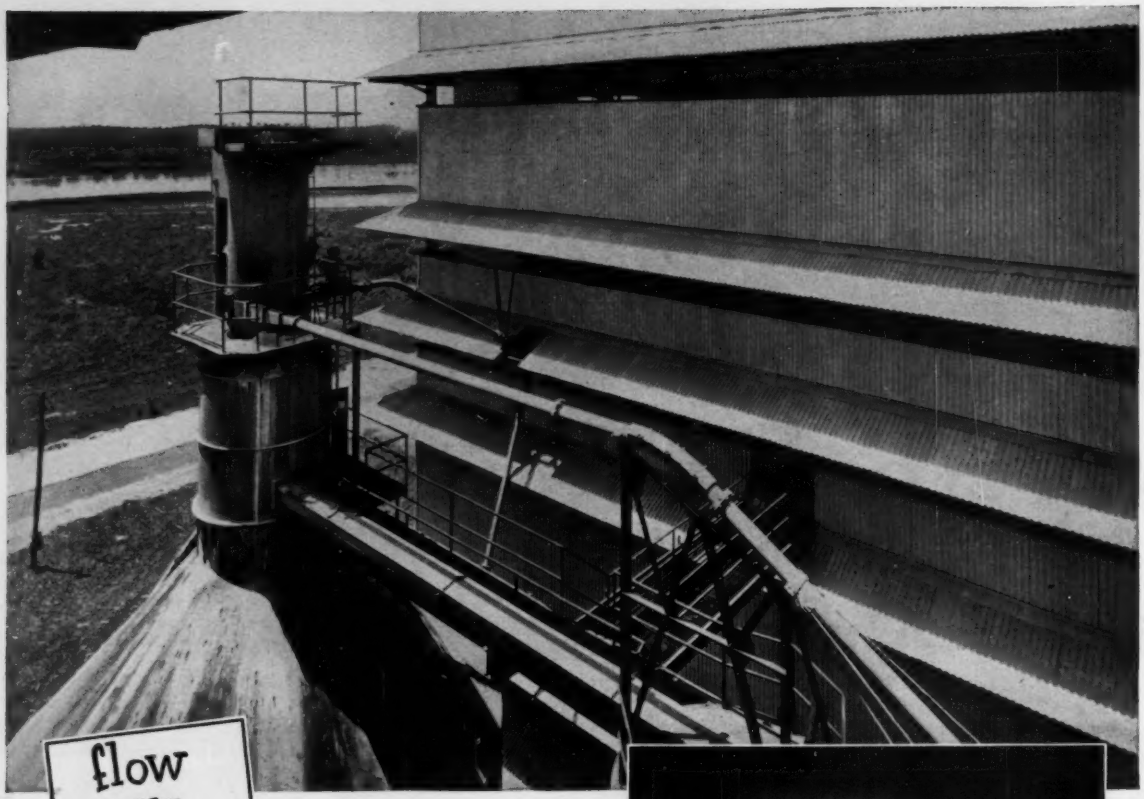
TRANE Heat Exchangers for two-stream, higher-pressure applications. Can be used for industrial and process applications requiring operating pressures up to 600 psig. Light and compact, they provide close temperature approaches economically.

For heating, cooling, ventilating, heat transfer...
For <u>any</u> air condition, turn to

TRANE

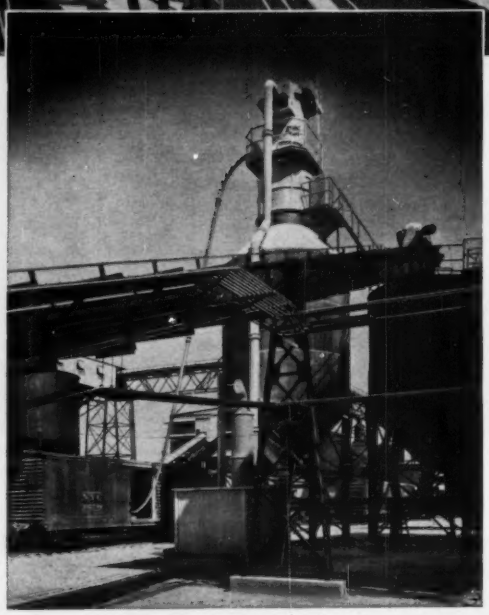
MANUFACTURING ENGINEERS

The Trane Company, La Crosse, Wis. • Eastern Mfg. Div., Scranton, Pa. Trane Company of Canada, Ltd., Toronto • 90 U.S. and 17 Canadian Offices



flow your bulk chemicals

from cars to storage...in-plant to process *with* **the AIRVEYOR®**



Handling your mill-supply chemicals . . . lime, soda ash, salt cake, starch and clays with the Airveyor—unloading from cars to storage or in-plant conveying—is the simplest, cleanest, and most economical method of doing the job.

Illustrated is an Airveyor installation in the south. Upper photo shows a system for unloading salt cake from cars to two storage bins at rate of 10 tons an hour. Also reclaims from storage and delivers to a service bin in the recovery building. Lower photo shows another system in the same plant unloading pebble lime at rate of 10 tons an hour, delivering to storage in the causticizing plant.

Well over 100 Airveyor systems are in service in the pulp and paper industry in the United States and Canada. This popularity is due to its inherent ability to perform, day in and day out, efficiently and with minimum attention and maintenance expense.

Fuller Company experience of over a quarter century in air-conveying places it in a top position to recommend and design a system that will give you the most economical results. A study of your operation will cost you nothing . . . may well show the way to consistently profitable operation and a smoother flow in production.

FULLER COMPANY
134 BRIDGE ST., CATASAUQUA, PA.
GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY
Chicago • San Francisco • Los Angeles • Seattle • Birmingham

FULLER COMPANY GENERAL AMERICAN TRADE MARK

Fuller
. . . . pioneers in harnessing AIR

A-207
1567

"THE BRAND OF PROGRESS"

By Heat Exchanger Specialists

▲ SYNOPSIS OF AD #10: In these days of rising material and labor costs, Western Supply is constantly on the lookout for new economies to pass on to their heat exchanger customers. Progress in this effort is reflected in the company's experience in finned shell-and-tube exchangers, which, by increasing the heat transfer surface of the tube approximately 2½ times, makes smaller exchangers and fewer exchangers possible for a great many applications. With this appreciable backlog of experience, Western stands ready to consult with you on finned tube design for your heat exchanger requirements.

CHECKING EACH OTHER WHILE THEY CHECK THE EXCHANGER

Even when fine materials, modern equipment, and highly skilled labor are used . . . *quality* can't be taken for granted. Men and machines *still* make mistakes . . . and heat exchanger mistakes are costly and dangerous.

The insurance companies first appreciated this danger and, soliciting the help of the ASME, the Pressure Vessel Codes were formulated. Soon after publishing, these codes were written into most state laws to assure safe operation of pressure vessel equipment.

At Western Supply many man hours go into the fabrication of a heat exchanger. Each operation is checked by company inspectors. But final testing and checking brings the most painstaking examination of all. Here the equipment, and its performance in the test bay, is minutely checked by Western's inspector . . . the insurance company's inspector . . . and, often, by the customer's inspector — three men who KNOW heat exchangers. The result, on a coded exchanger, will be stamping such as shown above. This stamp, made on the shell of the exchanger, gives the name of the manufacturer; working temperatures for both shell and tube side; serial number; year built; code symbol; and, finally, the inspector's stamp of approval. Now the exchanger is ready to ship. At the same time, Western mails its Manufacturer's Data Report to the customer and insurance company — a complete and detailed thermal, mechanical and material specification on the equipment. Enclosed with these reports are the graphs of pressure tests.

Western designs for quality . . . builds for quality . . . but never takes quality for granted.

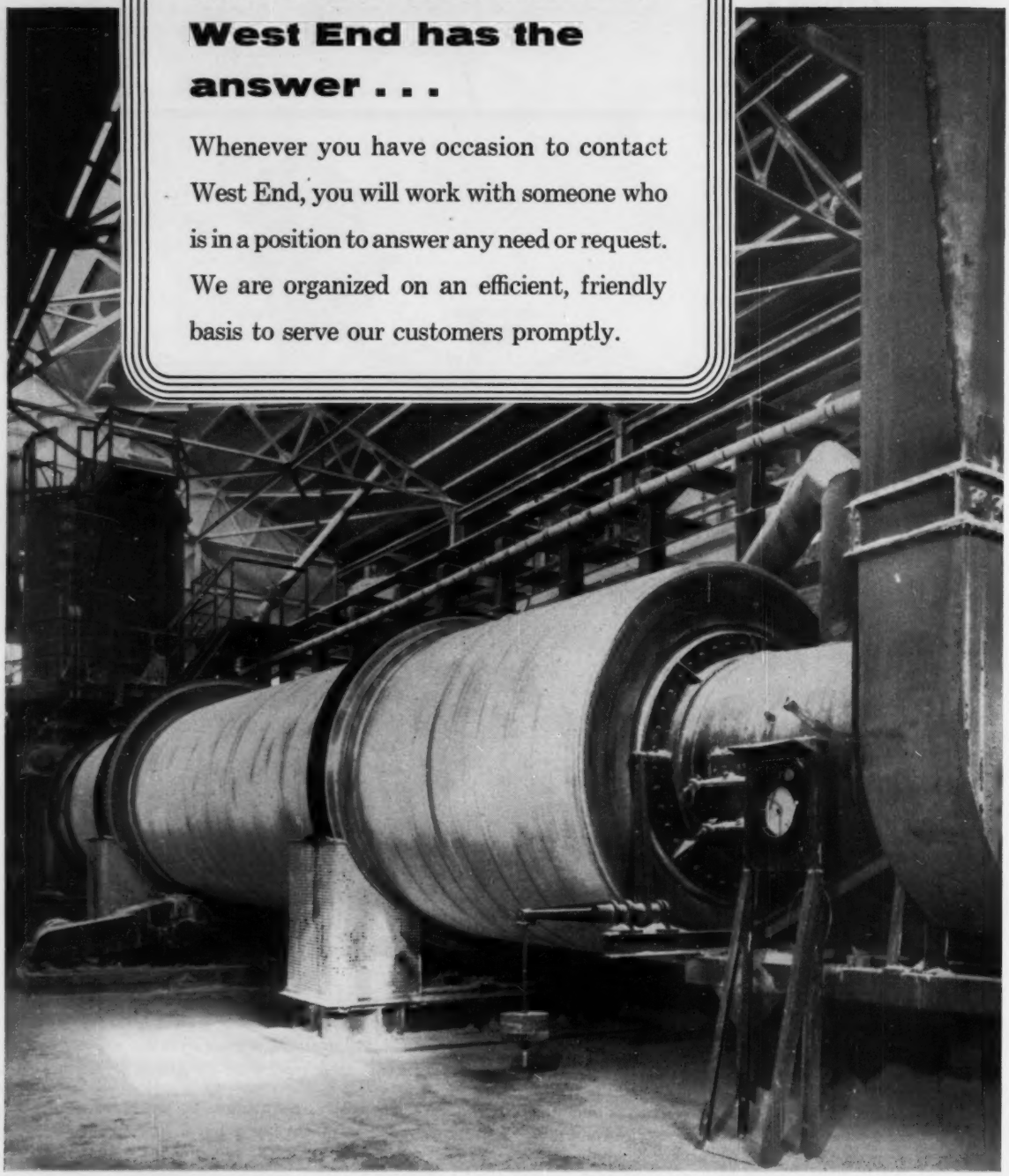
WESTERN
HEAT EXCHANGERS

WESTERN SUPPLY COMPANY
P. O. BOX 1888 • TULSA, OKLAHOMA

HUDSON-RUSH COMPANY—753 Gladstone Blvd., Shreveport, La.
130 Casa Linda Plaza, Dallas 18, Texas
PROCESS INSTRUMENTS & EQUIP. CO.—North Bldg., Charleston, W. Va.
H. W. SEVERANCE—Marion E. Taylor Bldg., Louisville, Ky.

the soda ash man at West End has the answer . . .

Whenever you have occasion to contact West End, you will work with someone who is in a position to answer any need or request. We are organized on an efficient, friendly basis to serve our customers promptly.



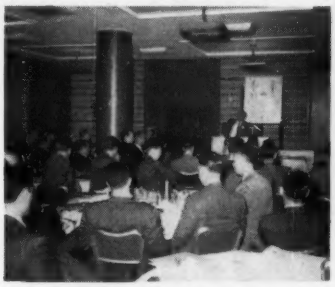
WEST END

West End Chemical Company

SODA ASH • BORAX • SODIUM SULFATE • SALT CAKE • HYDRATED LIME

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIFORNIA • PLANT, WESTEND, CALIFORNIA

CORPORATION BRIEFS

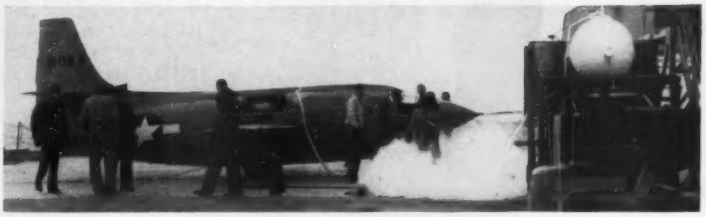


VALVE CLINICS

In spite of our belief that the Cooper Alloy stainless steel valve offers the best in design and operating features, we take it to school regularly. This "school" consists of continual study by field engineers observing the valve in service, by design engineers alert for new materials and construction methods, and by industry itself subjecting it to intensive examination and reporting their findings at organized Valve Clinics.

Cooper Alloy Area Valve Clinics have been held in most major industrial centers, and our in-plant clinics have been held on the spot in dozens of leading plants, including Dow, DuPont, Mathieson, Celanese, Pfizer and many others. At these meetings our staff presents its findings, listens to the findings of users, specifiers and buyers, and attempts to work out specific problems.

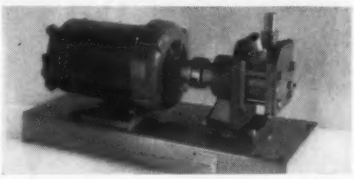
Arrangements for such a clinic in your own plant may be made through our Public Relations Division.



FAST AND COLD

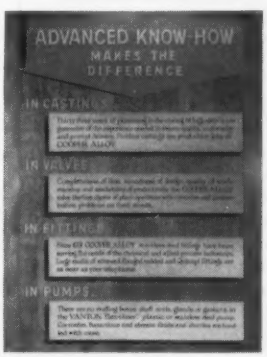
On October 14, 1947, the Bell X-1 made history by flashing through the skies faster than sound. A short time later the announcement was made official and acclaimed second in importance only to the first flight of the Wright Brothers in 1903. Cooper Alloy is proud to have been teamed with the Glasby Company in helping Bell Aircraft carve its notch in history by furnishing the 30″ diameter, 3″ wall stainless steel sphere required for handling the liquid nitrogen. Advanced Know-How makes the difference when it comes to meeting and maintaining rigid standards . . . Bring those problem castings to us and watch them turn into trouble-free production jobs.

"FLEX-ALLOY" STAINLESS PUMP



A new line of stainless steel rotary pumps for corrosive solutions, abrasive slurries and fluids which must be kept free from contamination has just been announced by our Vanton Pump & Equipment Division. Called "Flex-Alloy" these new pumps in type 304 or 316 stainless (other alloys on request) incorporate the same no-stuffing box, no-shaft seals, no-gasket features of the popular "flex-i-liner" plastic pump series. Full details given in Bulletin VP561.

For the thousands who visited the Chemical Exposition, these photos will be a pleasant reminder of an excellent show . . . for those who couldn't make the trip, they will help highlight the Cooper Alloy story.



COOPER ALLOY
CORPORATION · HILLSIDE, N. J.

Divisions:
FOUNDRY PRODUCTS DIVISION · VALVE & FITTING DIVISION · VANTON PUMP & EQUIPMENT CORP.
STAINLESS ENGINEERING AND MACHINE WORKS DIVISION · AIRCRAFT PRODUCTS DIVISION

on AL Stainless Plates

For certified data on individual grades of Stainless Steel, use

ALLEGHENY LUDLUM BLUE SHEETS

There is a Blue Sheet for each individual grade of AL Stainless Steel, giving full information on its physical and chemical properties and characteristics. Let us send you this certified, laboratory-proved data on the stainless grades in which you are interested.

ADDRESS DEPT. CE-74

WRITE FOR YOUR COPY!

For any job which involves the handling of large volumes, heat and high pressures—either singly or all at one time—AL Stainless Steel Plates, solid or clad, are produced in the exact grade and surface finish required to combat corrosion, oxidation and contamination of the product.

Some of these grades are *new* . . . comparatively recent developments of our research and experience as a pioneer and leader in stainless steel production. Others are improved versions of older analyses. The latest information on the entire subject of stainless plates is available to you in the booklet illustrated above—32 pages of valuable data on types, sizes, finishes, fabricating methods and uses, including ASTM and ASME boiler codes.

● Specify AL Stainless Steel for complete reliability in solid or clad stainless steel plates, and write for your copy of the AL Plate Book. Address: *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*

For Stainless Steel in All Forms—call

ALLEGHENY LUDLUM

AL STAINLESS STEEL

WAD 8776

Warehouse stocks carried by all Ryerson Steel plants

THE NEW **CHIKSAN**

Hydraulically Controlled

MARINE LOADING ARM

The first basic improvement for loading and unloading of petroleum products in over 30 years.

- Speeds tanker turn-around-time
- Far less manpower to operate
- Long life, trouble free operation
- Elimination of hose bursts
- Lowers fire and work compensation premiums
- Operates from –60°F. to +225°F.
- One motor, one switch controls operation
- Static and spark resistant
- No manhandling of hose

CHIKSAN COMPANY; Brea, California

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122

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Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Co., Brea, Calif., Newark 2, N.J. • Chiksan of Canada, Ltd., Edmonton, Alta.

PERFORMANCE VERIFIED / by acid test

Even before a Powell Corrosion Resistant Valve is made, it must pass the acid test. For quality control begins with the very materials which go into Powell Valves.

Constant laboratory control is one of the many ways we make certain that Powell Corrosion Resistant Valves will give dependable flow control. Another is the final step of manufacture: *every Powell Valve is subjected to an actual line test.*

To keep pace with the rapidly expanding chemical and process industries, Powell has designed many new types of Corrosion Resistant Valves. The variety of pure metals and special alloys in which they are available has grown to such an extent that today there is a Powell Corrosion Resistant Valve to control the flow of almost every known, corrosive fluid.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our COMPLETE *quality line* which has PERFORMANCE VERIFIED.

The Wm. Powell Company, Cincinnati 22, Ohio . . . 110th YEAR

PERFORMANCE PV VERIFIED

FIG. 1503 SS (Sectional)—150-Pound Alloy Steel Gate Valve.

FIG. 3065 SS (Sectional)—300-Pound Bolted Cap Alloy Steel Horizontal Lift Check Valve.

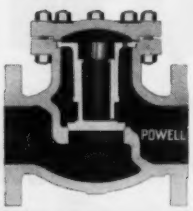
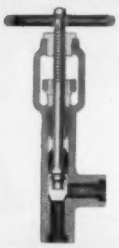


FIG. 1333 A (Sectional)—Integral Bonnet Angle Valve For Pressures of 1500 and 2500 W.S.P.

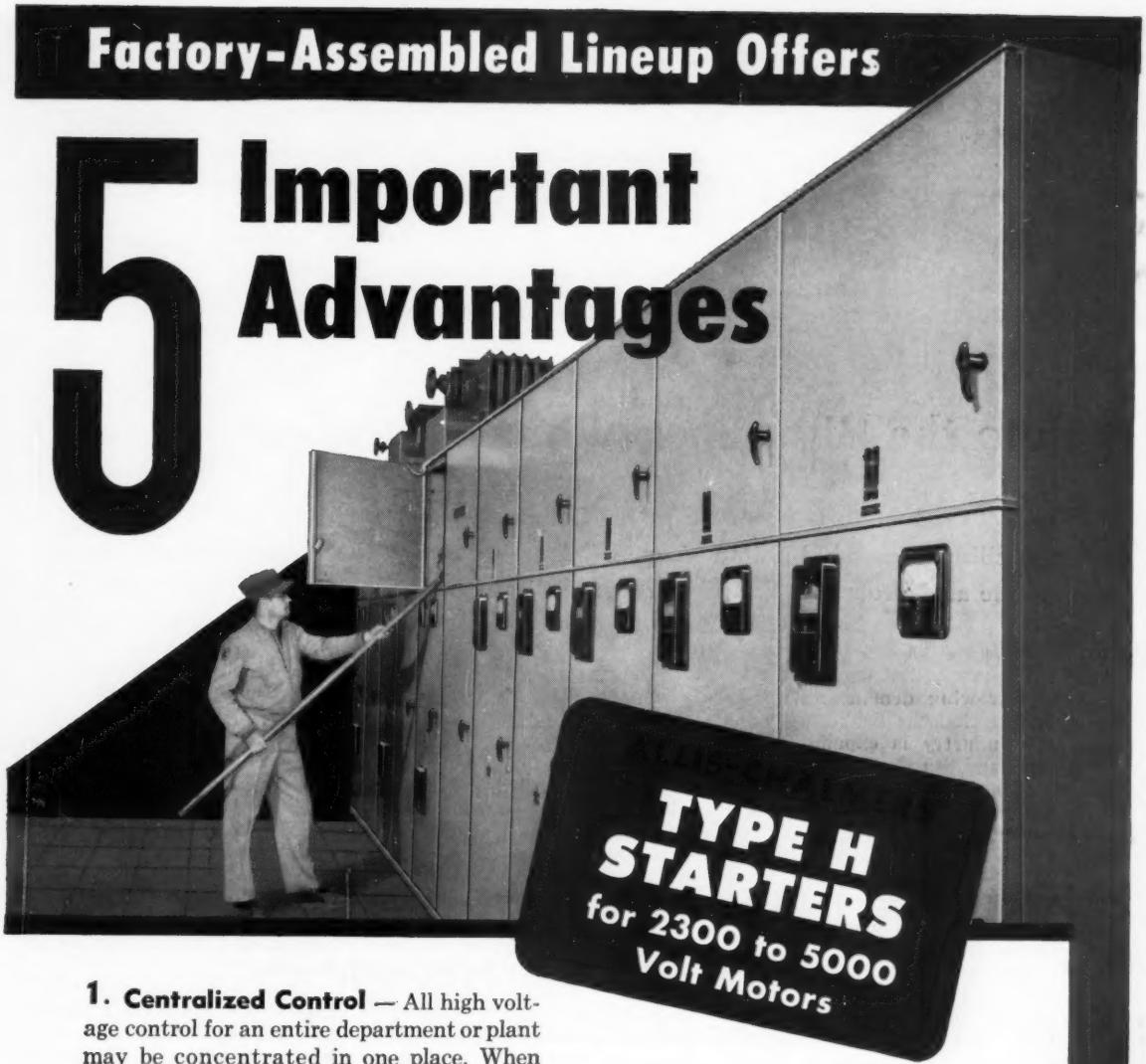


POWELL VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES.

Factory-Assembled Lineup Offers

5 Important Advantages



1. Centralized Control — All high voltage control for an entire department or plant may be concentrated in one place. When located in a separate control room, starter lineup operates in cleaner atmospheres. It also may be made inaccessible to unauthorized personnel.

2. Low-Cost Installation — Control group is factory-assembled *and bussed*. Conduit layout is greatly simplified. For example, lineup requires only one incoming power feeder.

3. Simplified Expansion — Internal bus and convenient wiring provision plus standardization of cubicle size facilitate addition of starters. Each starter unit is self-contained. Expanding the lineup is merely a matter of adding a starter and connecting the bus.

4. Attractive Appearance — Uniformity of cubicles presents a modern, streamlined appearance.

5. One-Company Responsibility Complete responsibility for assembling proper control devices and for control performance rests with Allis-Chalmers. A-4704

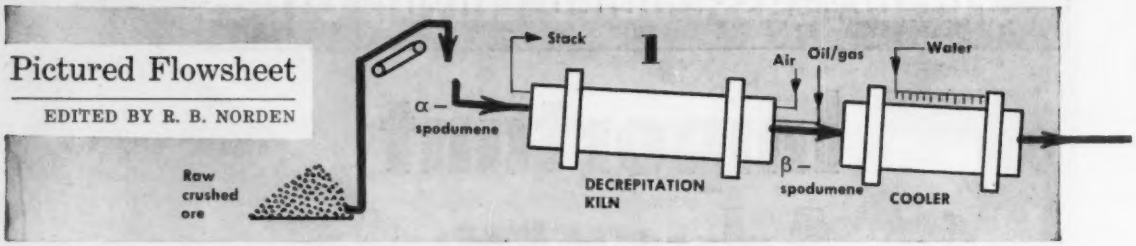
For complete information, see your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Pictured Flowsheet

EDITED BY R. B. NORDEN



COST-CUTTING conversion, in specially designed kilns, eliminates ore concentration in new Li chemicals plant.

Into the Big Time: Lithium Chemicals

Production is booming, prices falling. To meet a swelling demand, Lithium Corp. of America uses a unique acid process at the new Bessemer City plant.

Vigorously trying to satisfy ever-growing demands, it's no wonder that the lithium chemicals industry is expanding by leaps and bounds.

One of the largest of these expansions has just gone on stream at Bessemer City, N. C., where the Lithium Corp. of America has a glistening new $7 million plant turning out lithium hydroxide and lithium carbonate.

Contract arrangements prevent LCA from revealing their production capacity at Bessemer City. But the plant, together with recent expansions by Foote and American Potash makes lithium, with its alkali metal and alkaline earth properties, readily available.

Right now two commercial markets take a major share of production — multipurpose greases, where lithium hydroxide reacts with fatty acids yielding soaps for greases operating over a wide temperature range. And porcelain enamels and glazes where lithium carbonate serves to act as a flux, lowering the fusion temperature of ceramic mixtures.

▶ **Increasing Demand**—Increasing productive capacity and improvements in process techniques have already forced recent price reductions on both the hydroxide and the carbonate. All this activity promises wider applications in such fields as architectural porcelain enamels and the synthesis of chemicals.

Nowhere are these process improvements more in evidence then in the Bessemer City plant, where lithium chemicals are made via the "acid" process developed by LCA—sulfuric acid digestion of lithium bearing ore (spodumene); precipitation of lithium sulfate with sodium carbonate to form lithium carbonate; treatment of lithium carbonate with calcium hydroxide to make lithium hydroxide.

▶ **Unique Feature**—According to R. Nielson, Plant Manager, the key piece of equipment at Bessemer City is the 11-ft. dia. by 250-ft. long rotary "decrepitation" kiln designed and constructed by Allis-Chalmers.

In this kiln raw crushed ore containing 25% spodumene—which in turn has 1.5% lithium oxide—converts at 2000 F. from the naturally occuring alpha crystal form to the acid soluble beta. Decrepitation eliminates any need for concentrating ore.

The conversion isn't a simple operation, however. Raw ore contains mica, feldspar and other gangue materials. If the kiln temperature is kept too high, gangue starts to fuse with the spodumene, resulting in loss of lithium.

NEXT MONTH

Look for a description of a competitive route to the acid process for making lithium chemicals—the important alkaline process.

▶ **Making Lithium Sulfate**—Fine crushing of cooled (150 F.) beta spodumene takes place in a ball mill. Minus 100 mesh material goes to a pug mill (acid mixer) via a weighing belt conveyor. Here it's blended with 66 Be. H_2SO_4. Acidified ore feeds to a rotary acid-roasting kiln, where at 450 F. Li_2O goes to Li_2SO_4.

This is neutralized with limestone, filtered, and the filtrate treated in three 20,000 gal. tanks with sodium carbonate and calcium hydroxide solutions to precipitate calcium as carbonate and magnesium as hydroxide.

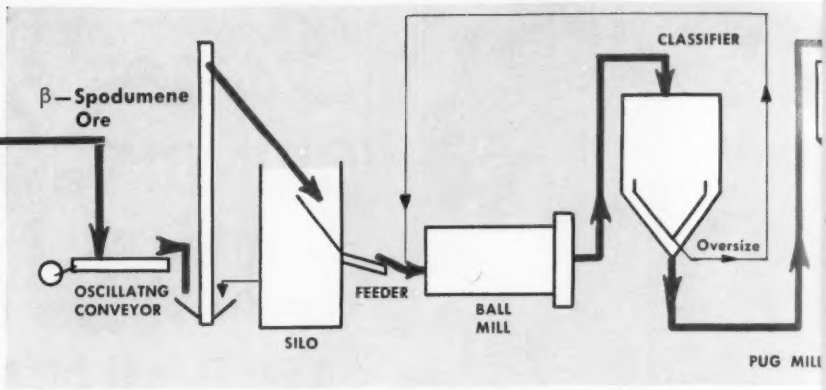
These solids are removed in leaf filters, the filtrate pumped to a pH adjustment tank.

▶ **Concentrating the Liquor**—In a five-effect evaporator, the concentration of the liquor is raised to 150 grams/liter of lithium sulfate. Aluminum is removed in a leaf filter, after treatment with carbon black.

In a lithium carbonate precipitation tank, a soda ash slurry reacts with lithium sulfate, forming lithium carbonate crystals and a sodium sulfate solution.

The crystals are washed with hot water on an automatic, four-cycle centrifuge. Part of the lithium carbonate (10% moisture) discharges to a rotary dryer, then to packing.

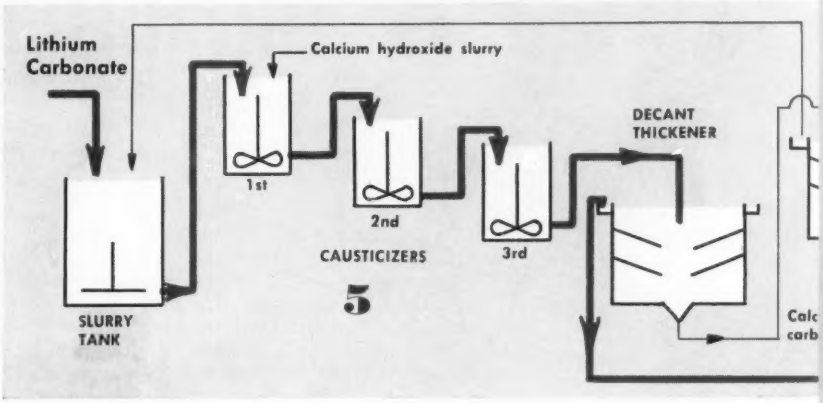
▶ **Next, Lithium Hydroxide**—Lithium carbonate (wet) is also used in producing lithium hydroxide, by reacting with calcium hydroxide. This is an equilibrium reaction, carried out in a countercurrent decantation sys-



tem (three causticizers, one settling thickener, and three washing-thickeners).

First, lithium carbonate is fed into a slurry tank with wash water from a washer-thickener. A proportioning pump then feeds the slurry to the first causticizer. Here the carbonate contacts a lime slurry.

The reaction produces a LiOH solution and a precipitate of calcium carbonate. Out of the third causticizer comes a solution containing 30 grams/liter of LiOH. At this point equilibrium has been reached, with the reaction about 75% complete. Reaction slurry overflows into settling-thickeners. Calcium carbonate, unreacted lime and lithium carbonate settle and are pumped to the washing-thickeners. Overflow is concentrated to produce LiOH.

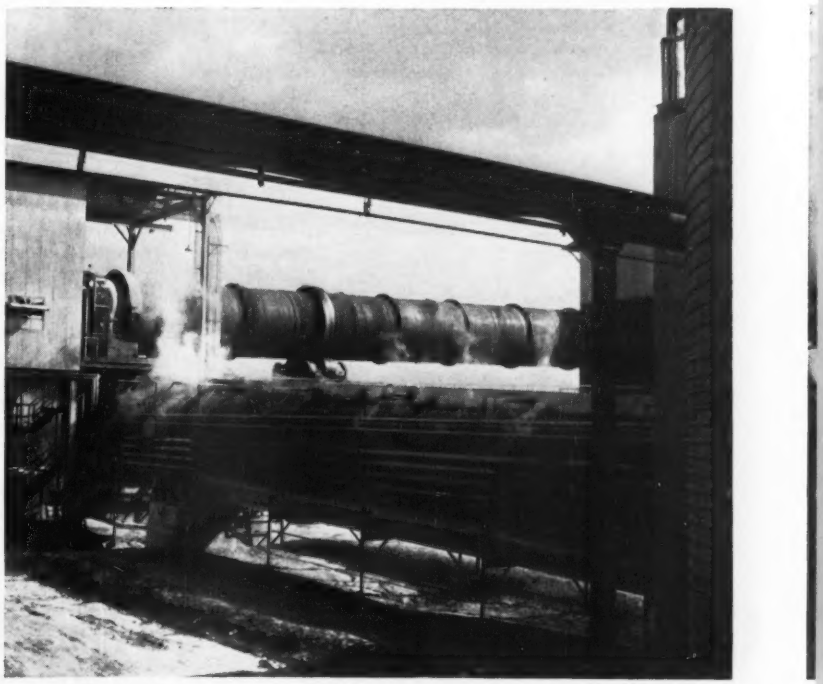


► **Why Washing-Thickeners?**—The washing-thickeners reduce LiOH cencentration, so the reaction can proceed to completion. And they also wash the calcium carbonate free of LiOH. Underflow moves countercurrent to a flow of hot wash water added to the third unit.

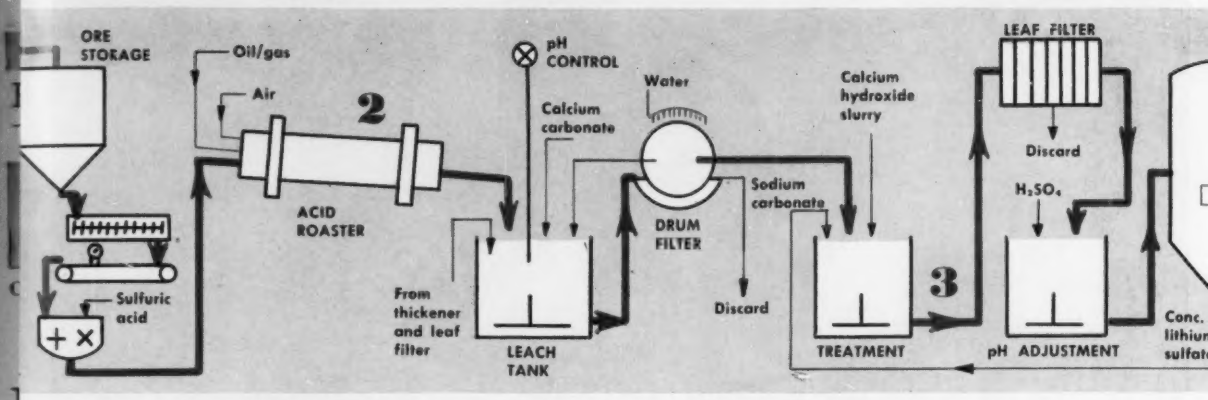
Let's get back to the overflow from the settling-thickener. A leaf filter first removes solids, then the filtrate is concentrated in a three-effect evaporator, where LiOH concentration is boosted from 30 to 130 grams/liter.

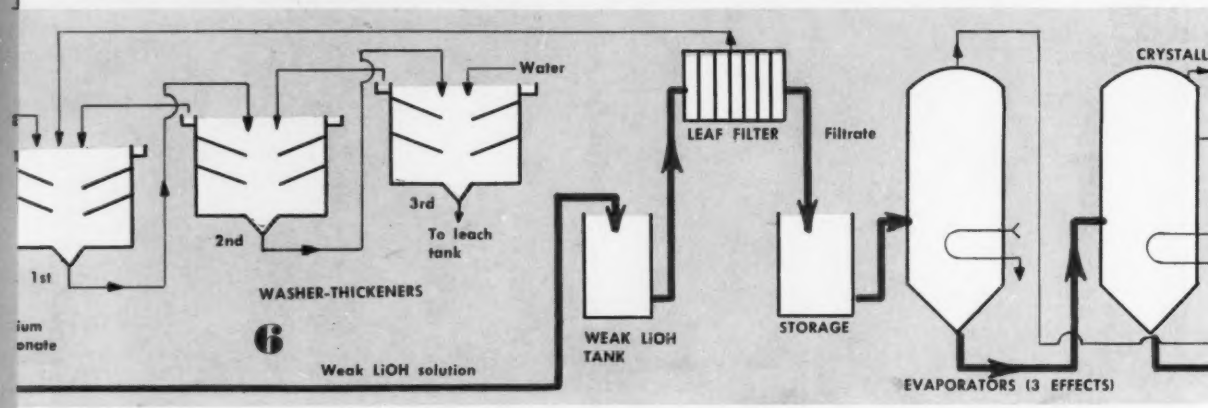
In a continuous vacuum crystallizer futher evaporotion brings out crystals of $LiOH \cdot H_2O$ as well as some contaminating $CaCO_3$. Slurry is pumped to a continuous centrifuge.

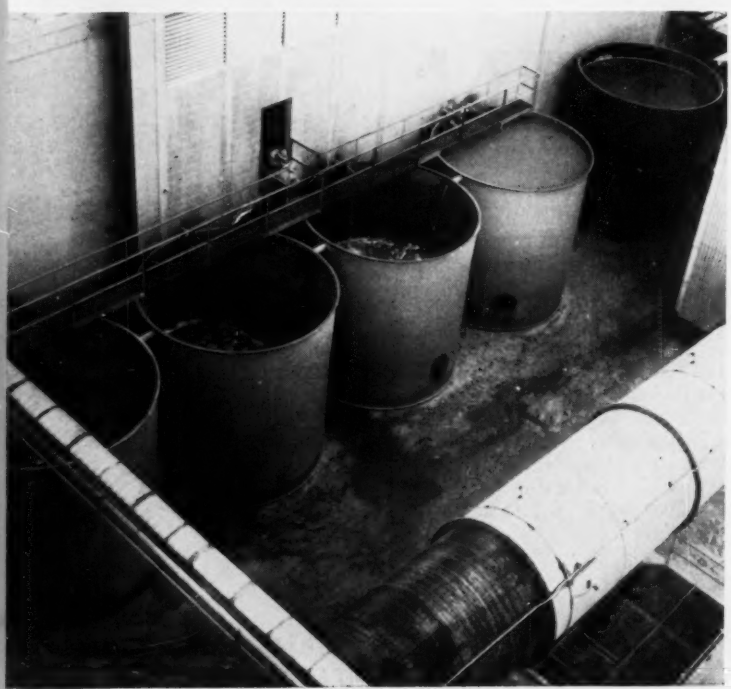
Filtered crystals are dissolved in water at 200 F., filtered to remove $CaCO_3$ and the liquor crystallized in a vacuum evaporator at 160 F. The slurry is filtered in a second centrifuge, then packed.



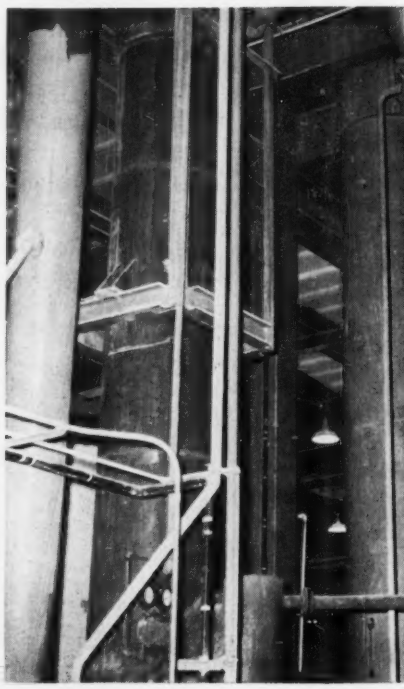
1 **DECREPITATION KILN (background) converts alpha spodumene to acid soluble beta. Beta ore is cooled to 150 F. in foreground equipment.**



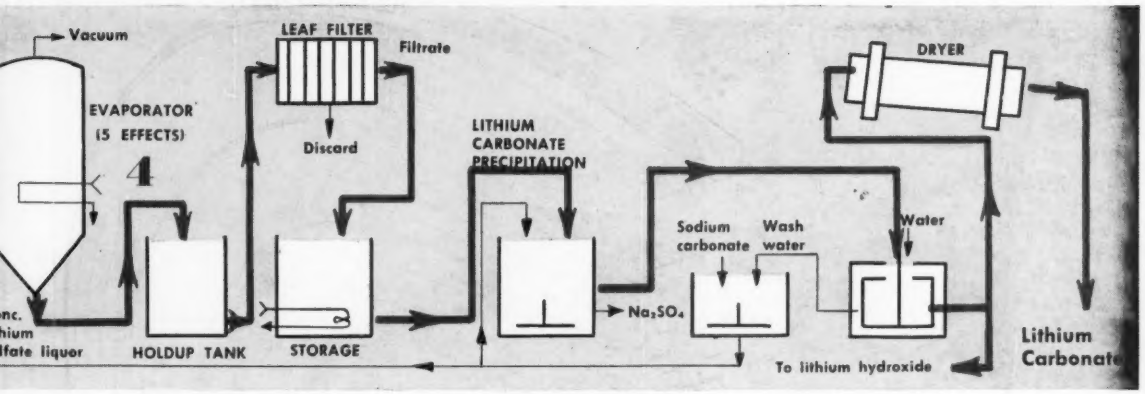


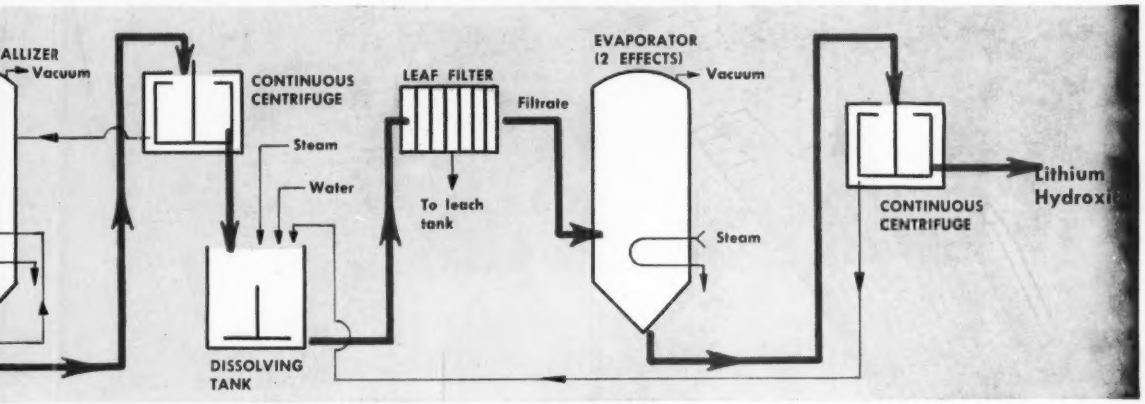


2-3 ACID ROASTING of ore with H_2SO_4 is vital in forming lithium sulfate. Impurities (Ca, Mg) are removed in treatment tanks.

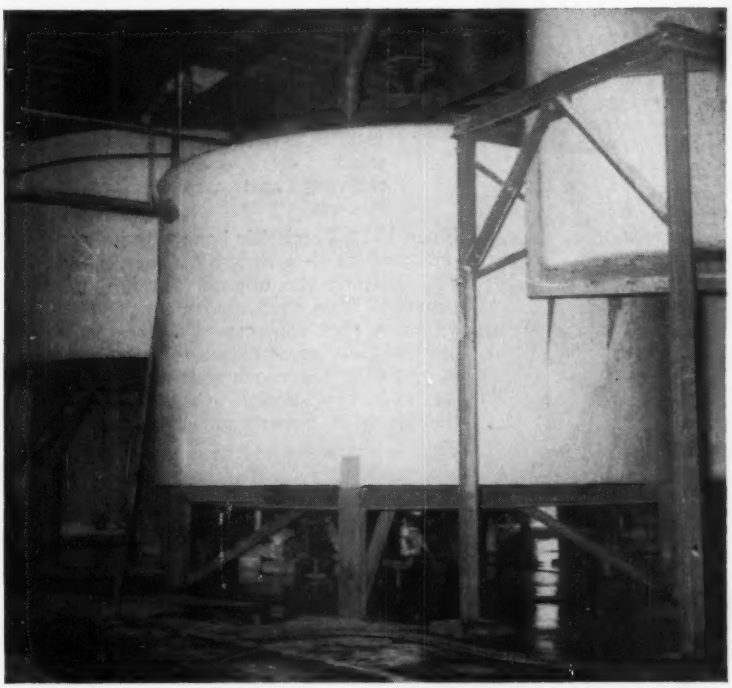


4 IN FIVE-EFFECT vacuum evaporato goes up from 30 to 150 grams/liter.





rator, concentration of lithium sulfate
r. First effect is in background.



5-6 CAUSTICIZER-COUNTERCURRENT washing system plays key part in LiOH production. Large tanks are washer-thickeners.

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(2) When flanged joints are subject to thermal and physical shock, corrosion, vibration, weaving and unpredictable stresses

Since 1912, Flexitallic has made only one product — a Spiral-Wound Gasket, built on the original Flexitallic principle. It's a uniquely resilient construction that compresses under the applied load, adjusts itself to changes in operating conditions without affecting gasket efficiency and then rebounds when bolting is relaxed.

That is why more and more engineers are marking their purchase orders: "Flexitallic — do not substitute."

Each Flexitallic Gasket is designed and engineered to meet specific conditions. Spirally-wound V-crimped plies of required metal with alternating plies of proper filler result in a resilient gasket having characteristics of a calibrated spring.

Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". In diameters to 84" O.D.

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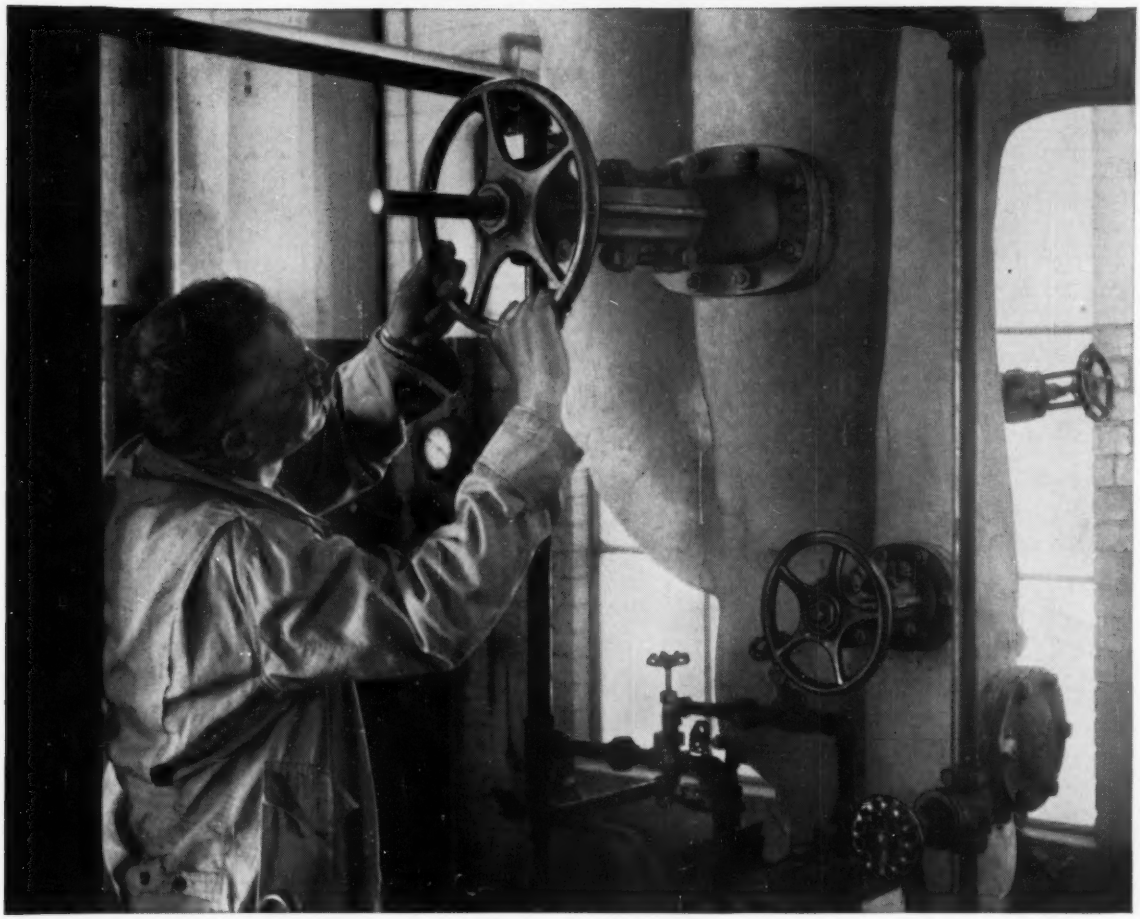
*Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue*—it's our exclusive blue-dyed Canadian asbestos filler.



Phenol at 350° F. no problem for these Crane Valves

THE CASE HISTORY—Refinery men know that handling hot phenol can be rough on valves and cause a lot of headaches. Or it can be a smooth, efficient valve operation—year in and out—as experienced here at the Continental Oil plant at Ponca City.

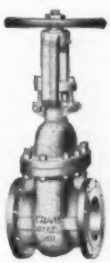
These Crane No. 47X 150-pound cast steel gate valves are on phenol service at 60 psi., 350° F. They're on the exhaust line from extraction tower bottoms pump in the aromatic extraction unit.

Installed in 1944, these Crane valves have required only routine maintenance. Operated about twice a month—they continue to make tight closure with ease—with no leakage or sticking.

Outwardly Crane valves may look like many others. But it's a mistake to assume all steel gate valves are alike.

The difference that's most important to you is inside—for instance, in the extra skill and care that goes into Crane seating design and materials. That's what makes Crane valves such outstanding performers on refinery services.

You can get Crane quality steel valves for every refinery need—gates, globes, angles and checks—with screwed, flanged or welding ends—in sizes up to 24 in.—in pressure classes up to 2500 psi.



Your local Crane Representative can give you valuable help in specifying and ordering.

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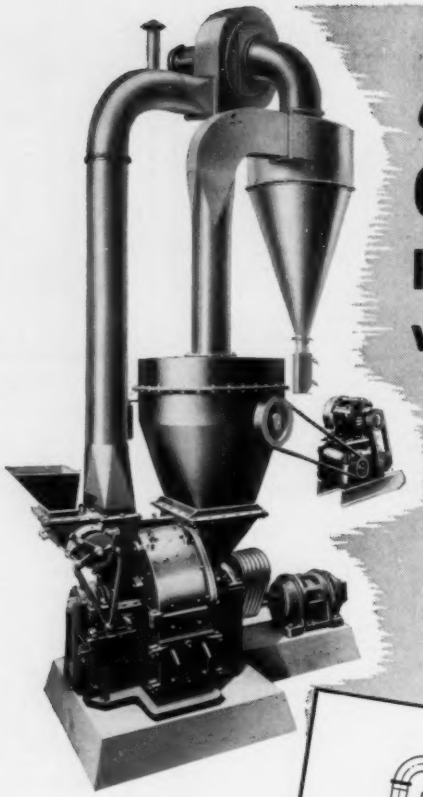
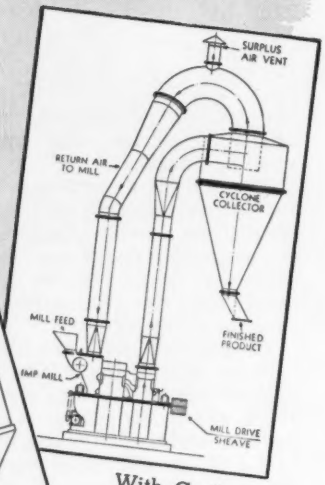
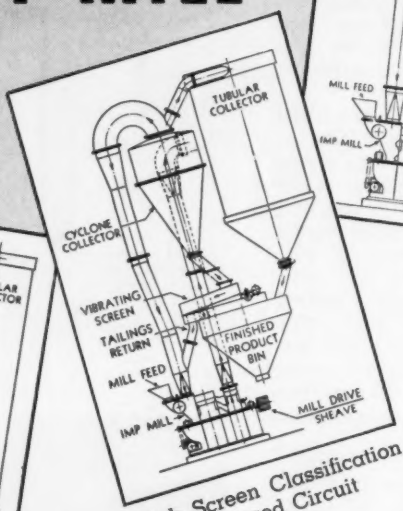
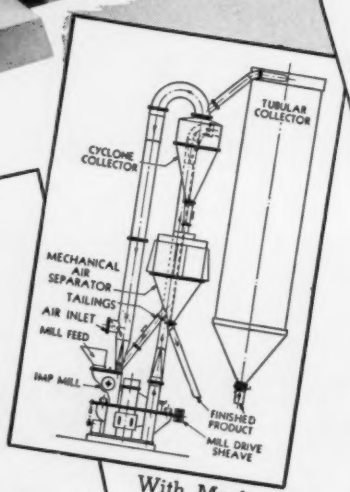




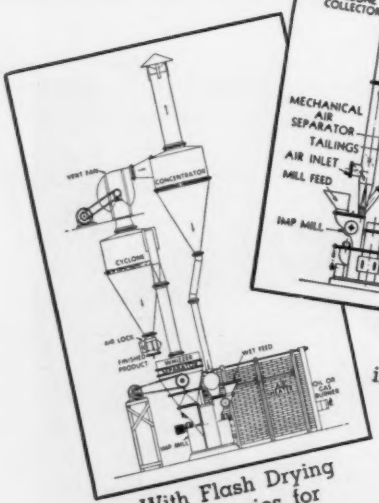
With Cyclone Collector and Piping



With Screen Classification in Closed Circuit



With Mechanical Air Separator in Closed Circuit



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EDITED BY M. A. GIBBONS

Robert T. Armstrong: Man of the Month

New Celanese vice president and technical director mirrors colleagues' thoughts

"Just how do you go about directing all the technical operations at Celanese, Dr. Armstrong?"

Once out, the words seemed a bit too blunt—possibly even a bit embarrassing for the man who would have to make a reply. Armstrong didn't seem disturbed but a revision seemed in order anyway:

"What I mean is, exactly where do you start . . ."

"I think I know what you mean," Armstrong smiled quietly. (He had come to the rescue.)

"And I don't think that's too hard a question to answer. You see, I don't really *direct* at all; I only *reflect* the ideas of the real directors—the men on our research staff—to management."

Expressed in a few simple words, Robert Armstrong's modest appraisal certainly underplays his vital new liaison role. Actually, though, as vice president and technical director for Celanese Corp. of America, there are countless tests of his grasp of the problems of the "real directors" he talks about. And when he "reflects" he does a whale of a lot of interpreting and digesting for management's consumption.

▶ **Broader Sphere of Influence**—Barely 46, Armstrong is rather young for such an assignment. But, for him, tying together research and management is nothing new. In fact, it's just an extension of the sort of thing he did for Celanese while technical director of the textile division during the past few years.

Under Armstrong's coordination of research and development, Celanese turned up a new triacetate fiber, tagged "Arnel." Fabrics made with Arnel fiber resist color loss, stretching, shrinking—even the glazing effect of ironing.

"The problem isn't to invent new fibers," according to Armstrong, "but to see that they have the singular quality consumers demand and that they are produced economically."

And now, it will be Armstrong's job to see to similar developments in the plastics and chemical divisions as well.

▶ **Off on a Tangent**—While he still served only the textile division, Bob used to break away from his tight circle of business chores once in a while. He and the family would dash off from Charlotte to the Coast for a weekend's relaxation on his small cruiser.

The 180-mile trek to Myrtle Beach (S. C.) seemed a bit ambitious for such a short time. But to Bob, it was well worth the effort. Ships and the sea have always fascinated him. And, above all, it was a great way of capturing a few quiet moments—which don't come along too often—when a man has a chance to relax and think things through.

Besides, it helped inspire those fine water colors that Janet (that's Mrs. Armstrong) occasionally turns out.

▶ **Well-Angled Triangle**—The new industrial prowess that a lot of people are predicting for the South has been getting a boost from many of the local gentry. In fact, Armstrong was picked by North Carolina's Governor Hodges as a key technical man to serve on a "triangle committee" which plans, in the long run, to see that his state gets an early taste of the potential boom.

The committee's more immediate goal, Armstrong claims, is to establish Raleigh, Durham, and Chapel Hill as points of a state triangle within which a great national research center would develop. Research will be a key factor because it paves the way for new ideas. Ideas, in turn, will shape the trend of economic development. Perhaps, after a hundred years or so of lag, industrial greatness will come to those Southern States who tap their potentials and turn them into progress.

Armstrong and the committee's other "Tar Heel" (or N. C.

THE IMPORTANCE OF PIGMENT PARTICLE SIZE

Color, tinting strength, hiding power, oil absorption, dispersibility, ease of grinding, suspension, freedom from abrasion, reactivity—these and other essential properties of pigments and extenders are directly related to pigment particle size.

In Williams' synthetic pigments—Kroma Reds; Pure red, yellow, black and brown iron oxides; chromium oxides; and Albacar calcium carbonates—particle size is carefully controlled at time of manufacture. Oversize is eliminated. Each of these types is available in a broad range of particle sizes.

In natural pigments, Williams produces specially sized materials, including VVF red oxides, metallic browns, siennas, umbers, and Sparmite (super fine Barytes). Here again, oversize is eliminated.

Below are the ranges of particle size distribution covering Pure Red Iron Oxides and Barytes. Other pigment groups have similar distribution ranges.

Always use Williams' *particle-size controlled* colors and extenders—and be sure of uniformity in the properties essential to the proper pigmentation of your product.

% BY WT. BELOW INDICATES SIZE

Micron Diameter	Pure Red Oxide		Barytes	
	Light	Dark	Sparmite	No. 1 Barytes
40	100	100	100	99.8
30	100	100	100	99.0
20	100	100	100	88.5
15	100	100	100	73.0
10	99.9	99.3	97.5	57.0
7.5	99.2	98.3	87.0	47.5
5	98.2	84.9	66.5	36.0
4	97.7	74.5	55.0	30.0
3	97.2	25.2	43.0	24.0
2	96.2	7.3	29.5	17.5
1	90.6	5.6	15.0	10.5
0.5	78.0	4.9	7.0	5.0

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State) leaders think the location ideal. Here, within a 25 sq. mile area, is a treasure of research facilities centered at the University of North Carolina, Duke University and North Carolina State College.

Lately, though, the committee (with tongue in cheek) has cited Armstrong as something of a renegade. He plans to extend the area of the research center to include the new Celanese development labs in Charlotte.

Despite the "indictment," however, Governor Hodges has asked him to continue with the committee even though he will no longer be a state resident.

► **Constant Factor**—Nine years ago, when Armstrong first came to Celanese, people there began to take notice. This new man was only in his mid-thirties. Yet, the ease with which he could grasp any new situation and keep track of all the familiar ones was never disrupted by anything—not even by the mighty stiff traveling schedule. No matter how many times a week his job sent him scurrying off on the road to another plant or lab, his quiet manner remained the same.

Actually, his knack of taking on complex situations, easily, goes back quite a while. Ever since his early teens, Armstrong enjoyed a busy schedule. While at school, he earned some of his expenses at various jobs—too numerous to list. Yet, his early achievements in his field include a scholarship at MIT as well as election to Sigma Xi.

And his calm manner certainly gives no hint of the many times he and his family have uprooted themselves, in past years, keeping up with his assignments. In 1937, he left Cambridge where he had taught for a few years. Then, with U. S. Rubber, in Passaic, N. J., he worked on polymer development and, as assistant department head, he also shared supervision of the work on insecticides and textile finishing agents.

Later, in 1944, the Armstrong's shipped out to Tennessee, where North American Rayon's tire-cord program proved a neat transition into the textile world. Now, with Celanese, he beats a path, regularly, among sites from New York to Texas.

E. Oden is now development section head for Chemstrand Corp. He had been president and consulting engineer with International Petroleum & Chemical Exchange.

John M. Bradley has been promoted to administrative asst. to the VP and manager of the carbon black div., Cabot Carbon Co.

Frank L. Rubin is now a sales engineer for the Pressed Steel Tank Co., div. of Downingtown Iron Works.

Emil Ott has been appointed director of central chemical research and a VP of Food Mach. & Chemical Corp.

Hans Beller has been named manager of the new acetylene products plant of General Aniline & Film Corp., in Calvert City, Ky.

George A. Gentes has been appointed asst. works manager of Hooker Electrochemical's Tacoma, Wash., plant; **R. Sherwin** is asst. plant engineer.

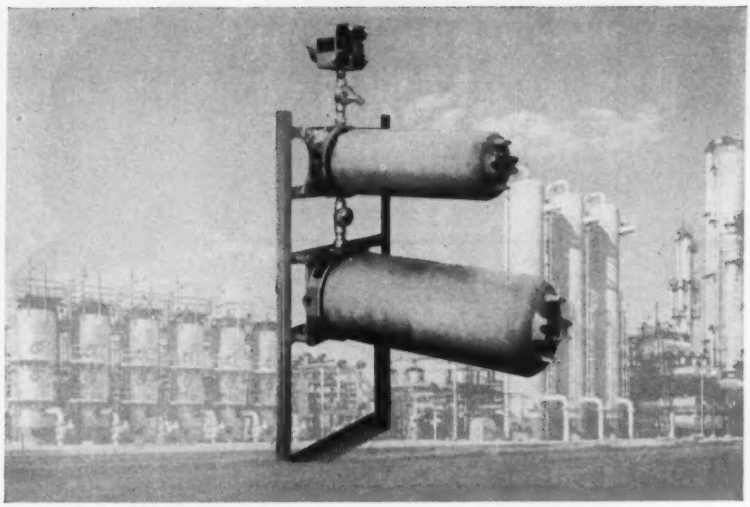
Wilbur Becker has been appointed plant manager of Hercules Powder's tall oil plant at Franklin, Va.

E. Pettyjohn has resigned as director of the Institute of Gas Technology. In former years, he also had taught chemical engineering at the University of Michigan.

Francis Jucaitis has been presented with the ARF chemical engineering research dept.'s award of scientific merit for his work in the development of a new rodent repellent for agricultural uses.

Don Grange has been appointed director of engineering for International Minerals. For the last 2 years, he had served as chief construction engineer.

Gilbert McEwan has been promoted to research group leader for Monsanto's inorganic chemicals div; R. Paul,



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Here is the first industrial infrared analyzer based on the proven principles of laboratory spectrometers and used for continuous monitoring and control of chemical processes. The Bichromator Analyzer is a two wave length, dispersion-type instrument, applying base-line density principles of the infrared laboratory to continuous process analysis.

It is an extremely stable and rugged instrument with no moving optical parts. The simple radiation null principle and closed loop servo system insure rapid response, virtual freedom from source or line current variation, or changes in amplifier linearity. This photometric system allows full-scale recorder operation with as little as 3% change in transmission.

The Bichromator Analyzer continuously measures the concentration of one component in an industrial sample. It is set on two wave length intervals; one, unique to the sample being analyzed (the component of interest), the other at a reference wave length where the sample does not absorb radiation. The energy difference at the two wave lengths is proportional to the concentration of the component of interest and can be converted to a measure of the concentration.

Thousands of laboratory infrared spectrometers now in use attest to the accuracy and stability inherent in the design of the dispersion instrument. Furthermore, the performance of the Bichromator Analyzer *can be predicted* from laboratory spectrometer data and tied to present laboratory control procedures.

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1 Sample cell in separately purgeable compartment outside main instrument for ease of checking without exposing instrument proper to plant atmosphere.

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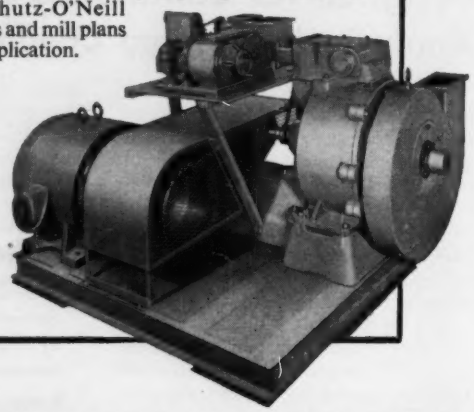

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NAMES . . .

Don Castle, and E. Take are new members of the technical services dept.

George Williams is director of technical products development for Kimble Glass Co., subsidiary of Owens-Illinois.

Harry A. Batley is Nopco's vice president in charge of industrial production. Twenty-five years ago, he began with the firm as research chemist.

Robert Lindley Murray

Hooker Electrochemical's chief executive and chairman of the board has been chosen to receive the Chemical Industry Medal for 1956 "for conspicuous services to applied chemistry."

Robert Lindley Murray, noted for his contributions to the development of the electrochemical industry, will receive the Award at a meeting of SCI's American Section, in New York, on April 27.

Richard M. McGhee is Commercial Solvents' new asst. chief engineer.

Henry Molteni is the new plant manager in charge of all plant operations at the Onyx Oil & Chemical Co.

Rolland Peters has been appointed technical coordinator of automotive finishes for Pittsburgh Plate Glass' paint div.; **Harry Vogt** has joined the development staff, Columbia-Southern Chemical Corp.

Martin Buck, asst. to the VP-mfg. at Shell Chemical, has been named to a senior position in the chemical manufacturing dept. of the associates at The Hague.

C. Ruebensaal has been appointed director of commercial planning for the Texas-U. S. Chemical Co.

George Fremon has been selected patent coordinator for Carbide & Carbon Chemicals Co.

Clark Barrett has been promoted from asst. plant manager of DuPont's Sabine River Works to plant manager of the Arlington, N. J., works. He will be replaced by John Oliver.

C. C. Thiel has been promoted to works manager of U. S. Gypsum's new paper mill in Houston.

Louis Munchmeyer has been named asst. general manager of Wyandotte's Michigan Alkali div.

Joseph D. Davidson, vice president of Union Carbide has been presented with the chemical industry medal for 1955 for "conspicuous services to applied chemistry."

Boyette Edwards has been named specialist—operations research projects for GE in Pittsfield, Mass; **James Whitney** is the new supt. of the phenolic products plant; **Kenneth Laut** will supervise manufacturing at the Coshocton O., varnish plant.

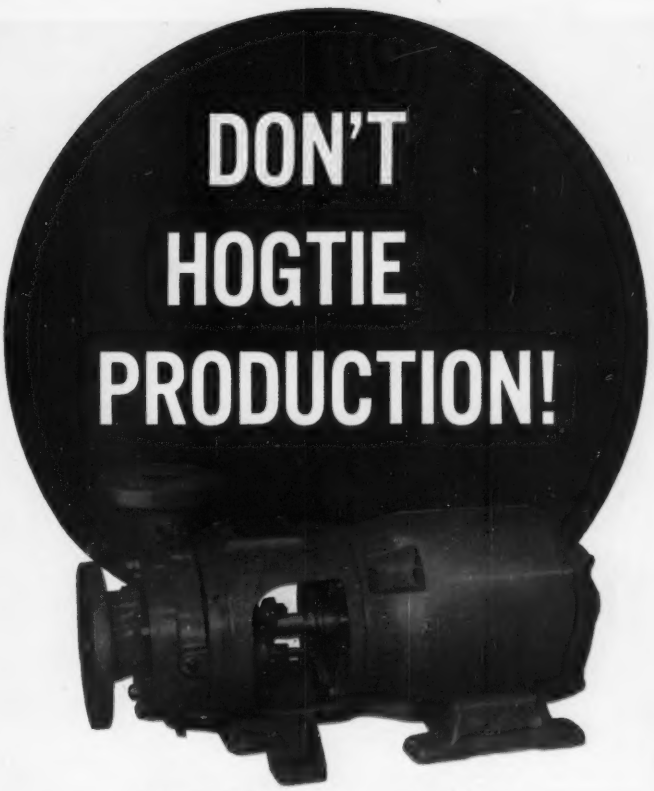
Kenneth Hines has been appointed project chief, systems div., at Consolidated Eng. He will specialize in petrochemical instrumentation.

Edward Massaglia has joined Atlas Powder as asst. general manager of the chemicals div. Formerly, Mr. Massaglia was VP and director of Pfizer International.

Lee A. DuBridge, president of Caltech, has been elected chairman of the Air Pollution Foundation in Los Angeles.

John R. Suman, petroleum consultant, has been presented with an award for outstanding leadership in the stand-

DON'T HOGTIE PRODUCTION!



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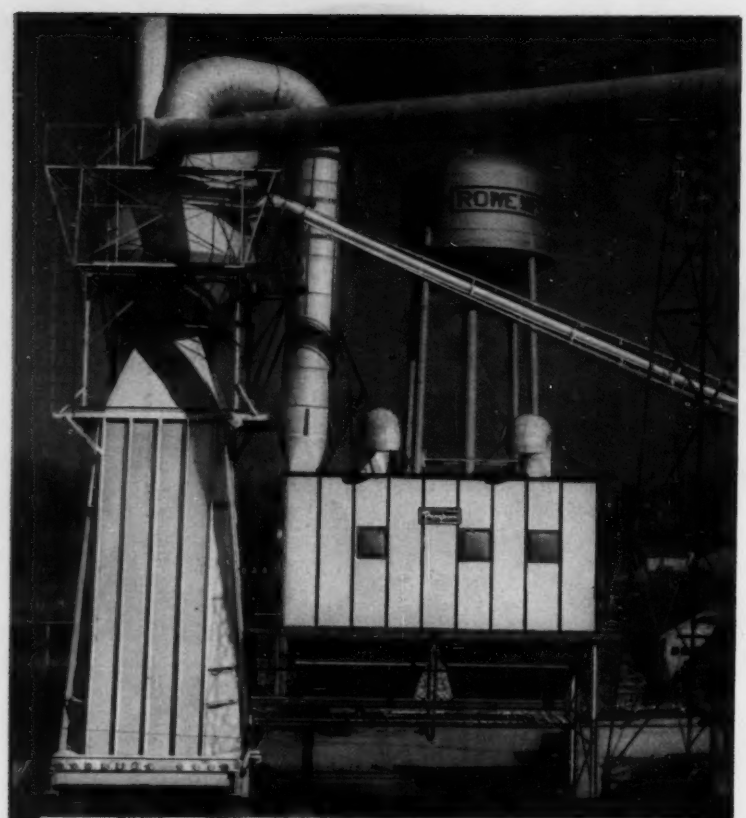

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Pangborn
CONTROLS DUST

ardization program of the American Petroleum Institute's div. of production. Formerly, Mr. Suman had been a vice president with Standard Oil.

Bruce B. Allen has been promoted to technical director of the textile div. at Celanese Corp. Dr. Allen had been director of research and manager of the firm's Summit, N. J., laboratories.

Francis E. Weisend has been named plant manager of B. F. Goodrich's Marietta, Ohio, plant. In Avon, Ohio, **Owen F. Beckmeyer** was named manager of the general chemicals plant, of B. F. Goodrich Chemical.

Clement Watson has been appointed general manager of General Foods' Atlantic gelatin div. He will succeed **Joseph Cohen,** retiring vice president and general manager.

William M. Saltman, formerly with Export Chemical Corp., has joined the diene synthetic rubbers section at Goodyear Tire & Rubber.

J. L. Harmon, an independent oil producer, has been elected chairman of the board of the American Petroleum Institute; **Frank M. Porter** was reelected president.

Alberto F. Thompson, chief of the technical information service (AEC), has joined the staff of the National Science Foundation.

Raymond E. Tuttle is the first manager of the new technical dept. at International Minerals' Bonnie Phosphate Chemical plant.

Howard Blyth has been appointed asst. to the general manager of the organic chemicals div., American Cyanamid Co.

William Canavan has been appointed asst. manager of the extrusion materials div., Bakelite Co.

Noah Davis, manager of the special products dept. of Becco Chemical div., Food Mach. & Chemical, has been elected president of the American Rocket Society.

E. D. Hilburn has joined the engineering staff of the Atlantic Research Corp.

Emil Ott

The new director of central chemical research and vice-president of Food Machinery & Chemical's chemical divisions is the former director of research at Hercules Powder Co.

Dr. Emil Ott will relocate his offices at FMC's new multimillion dollar research center, in Princeton, N. J., as soon as they are completed.

Born in Zurich, Switzerland, Dr. Ott came to this country in 1927. For a short time, he did development work at Stauffer Chemical until he helped staff the chemistry faculty at Johns Hopkins. In 1933, he joined Hercules.

Carl Arend has been appointed general manager of the potash div., International Minerals & Chemical Corp.

Alexander Andrew is now asst. supt. of the paper sensitizing div. at Kodak's Park Works.

Robert L. Pigford, chairman of the dept. of chemical engineering at the U. of Delaware, has received the '55 Professional Progress Award sponsored by Celanese and given by the AIChE.

Henry Groppe has joined **Joseph R. Mares** in his practice as an industrial consultant in Houston. Recently, he had

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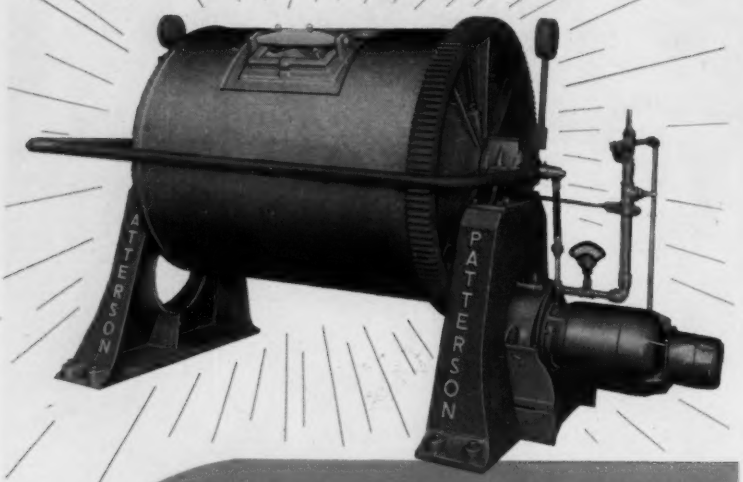

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served with Monsanto Chemical as asst. director of development for the plastics div.

Russell W. Mumford, VP and consulting engineer for American Potash & Chemical, has retired after 35 yrs. with the firm.

Lee H. Clark

The former general manager of Pennsalt's Sharples Chemicals div., Lee H. Clark, has been named vice president of the parent company.

"Corporate organization and planning functions" will probably occupy most of Clark's time, though the full scope of his new office is not yet known.

A native of Brooklyn and an alumnus of Cornell, Mr. Clark first became associated with Sharples some 35 years ago. Two years ago, he became its president.

Al Cereghino has joined the Trendex div. of the Humko Co. as head of sales and product development.

Raymond Friedman has joined the staff of the chemical engineering div., at Atlantic Research.

George E. Kopetz has been appointed vice-president-production at Blaw-Knox Co.

Frank M. Jones has joined the acrilan acrylic fiber mfg. plant of Chemstrand as asst. area supervisor of solvent mfg.

Charles Heiberger has been transferred to the central research lab, Food Machinery & Chemical Corp., as mgr. of plastics.

Lester J. Conkling, a chemical engineer with the Army Chemical Corps, has received the Nat'l Civil Service League's first annual service award.

John T. Castles is now manager of the elastomer market dept. for GE's silicone products.

M. V. C. Sastri, Indian scientist, will spend three months studying catalytic research at the Houdry Process labs—under a US State Dept. exchange program.

Ed D. Anderson has been promoted to manager of Western Supply's heat exchanger div.

E. Newcomb has been elected president and chief executive officer of Malmstrom Chemical.

Macedonio Vela and **A. Torrenzano** have joined Monsanto's plastics div.; **A. S. Krisher** is an engineer with the inspection and corrosion group, Texas City.

Charles Carpenter is asst. manager of market development for Metal & Thermit Corp.

H. Sandlin is now supervisory process engineer of Magnolia Petroleum Co. **Robert Bowden** is asst. chief process engineer and **Shelby Gibbs** is supervisory process engineer in the lube oil process control section.

Edward Block, Wm. Foster and **Laurance Rockefeller** were elected to the board of directors at Olin Mathieson Chemical Corp.

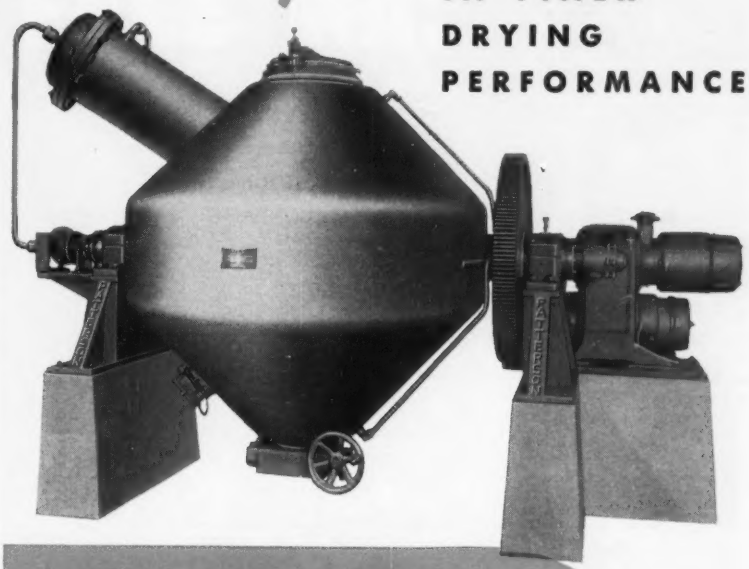
John Powers and **O. K. Crosser** have joined the chemical engineering staff at the University of Oklahoma.

B. W. Haskell has been appointed field project engineer of Rayonier's new $25 million chemical cellulose mill at Jesup, Ga.

Howard E. Hughes has been promoted to the position of superintendent of Shell Chem-

Typically Patterson

IN FINER DRYING PERFORMANCE



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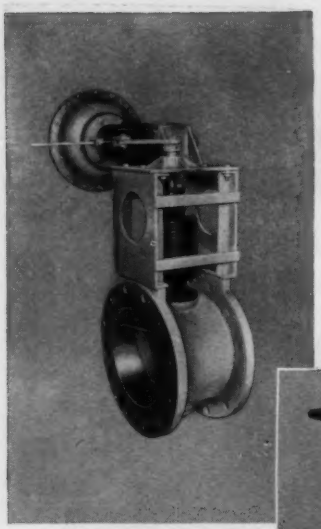

Special 12-inch R-S Butterfly ▲ Valve, with finned lubricated stuffing box, is used for service with hot gases at 1,000° F.

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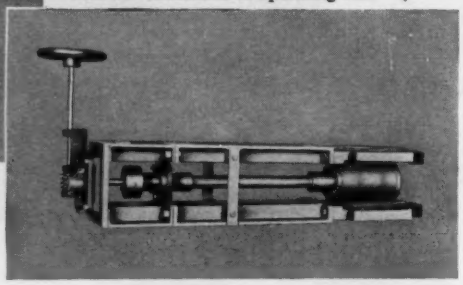
All-bronze, 150-pound R-S Valve for operation at—300° F. Valve is installed with 18" insulation in operating cell. ▼



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If your past experience offers no precedent, you can call on our background in specialized valve engineering to solve material problems.

We have built valves to operate in a temperature range of from —300° F to +2,000° F. For complete information on our complete line of butterfly, ball and cone valves, see our local representative or write S. Morgan Smith Company, York, Pennsylvania.

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ical's Houston plant. Hughes replaces **F. Watson,** who has been named asst. to the VP of manufacturing in the NY office.

Arnold L. Coldiron has been awarded the $1,250 Maloney-Crawford Tank & Mfg. fellowship in chemical engineering at the U. of Oklahoma.

Capt. Robert S. Day, of the US Army Chemical Corps, has been named registrar at West Point Military Academy. Prior to this appointment, Capt. Day had served as chemical engineer at the Rocky Mt. arsenal in Denver.

Assn. of Consulting Chemists & Chemical Engineers, Inc., has elected **Foster Dee Snell,** vice-president, and **Percy E. Landolt** (Landolt & Whitney) councilor. **Charles Davidoff** and **Abraham Taub** are "hold-over" councilors.

Charles F. Fuchs has been elected a member of the board of directors of Emulsol Chemical Corp. Fuchs is also VP and technical director.

Frederick S. Rich, formerly senior instrument engineer for Arabian American Oil, has been appointed petroleum industry coordinator for Fischer & Porter.

Wm. Schubert, Robert J. Booker, Charles Benford, and **Bruce Sweringen** have joined the staff of Procter & Gamble Co.

H. H. Douglas has been promoted to asst. general mgr. for Pittsburgh Plate Glass' paint div. **Laurence Streff** is now divisional engineer in Pittsburgh.

William E. Ranz, associate professor in engineering research at Penn State, has received the 1955 AIChE Junior Award.

Seymour H. Mann has been selected chief of Riker Laboratories' mfg. operations.

Roger J. Williams, University of Texas professor, has been

chosen president-elect of the ACS. Prof. Williams discovered vitamin pantothenic acid and pioneered the use of folic acid to fight nutritional anemia.

OBITUARIES

James McElgin, manager of the metal-working dept. of E. Houghton & Co., died suddenly while on business in Chicago, on Dec. 7.

P. Val Kolb, 70, president of Sterwin Chemicals, died Dec. 5 at Rock Hill, S. Carolina.

Frank E. Rehm, 61, retired vice president of Shell Oil, died Nov. 27 at his home in San Francisco.

Sumner David Andrew, associated with International Paper Co. for 26 years, died at the age of 68 in mid-November.

Gerhard Rollefson, 55, professor of chemistry at the University of Calif., Berkeley, died of a heart attack on Nov. 15. Since 1947, he had served as consultant at the Los Alamos laboratory.

C. A. Gillingham died Nov. 10 of a heart attack. For many yrs., Mr. Gillingham was head of the specification and quality control dept. of Nat'l Carbon.

Wm. Waldie, retired technical director of New Wrinkle, Inc., died Nov. 5 at the home of his son in Delaware, Ohio.

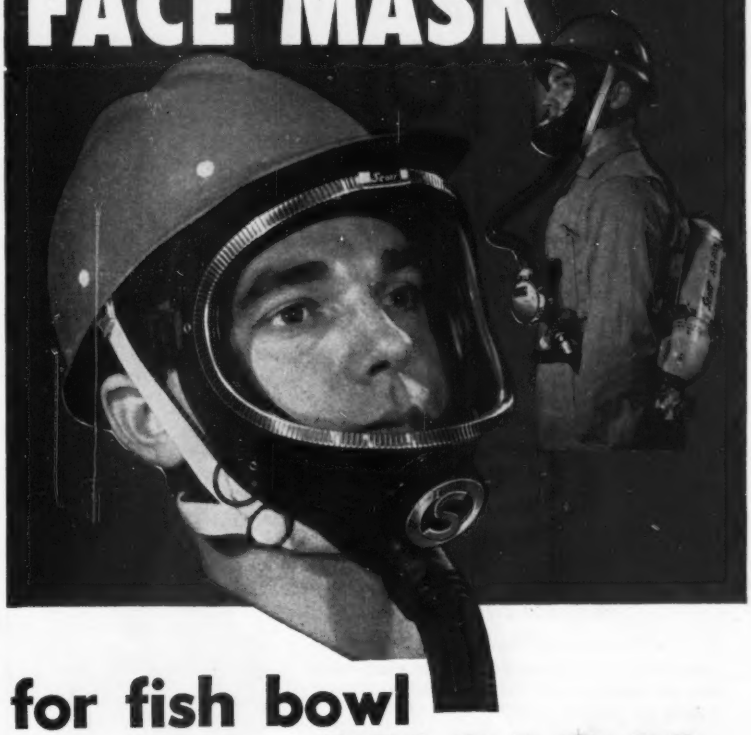
Max Neuhaus, 48, VP in charge of research and development for Jefferson Chemical, died Nov. 5 in Houston.

Wm. Yaroch, VP and technical director of Klem Chemicals Inc., died early in November after a prolonged illness.

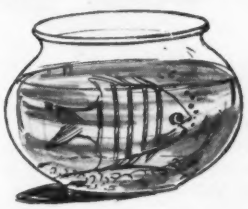
Earl C. Petrie, director of research at No. American Refractories, died Nov. 2.

M. A. Abernathy, 62, senior VP and member of the board of directors at United Gas Corp., died Nov. 2, in Shreveport, La.

NEW SCOTTORAMIC FACE MASK



for fish bowl VISION



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It eliminates any feeling of claustrophobia or fatigue due to working with hampered vision.

Men work faster, more accurately and are comfortable for longer periods of time with the new Scottoramic full-vision face mask.

It may be worn over some types of glasses. Double-lip seal is positive assurance against smoke and toxic gases reaching the wearer. Non-fogging is assured by the circular air-washing action of the cool air.

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THIS MONTH'S

Technical

BOOK REVIEWS

The New Badger

INTRODUCTION TO CHEMICAL ENGINEERING. By W. L. Badger and J. T. Banchero. McGraw-Hill Book Co., New York. 753 pages. $9.50.

Somehow, I suppose we were cheated. In my undergraduate days Badger and McCabe was already an older text (1936). So our faculty led us through the newer Walker, Lewis, McAdams and Gilliland (1937). (Not without some difficulty, I'll admit.)

Then in my first job I soon met the guys who swore by Badger and McCabe. They kept the thumb-worn copies on their desks and referred to them as many times as they reached for Perry's Handbook. To them no other text on unit operations existed. (Later we were to meet some Michiganites who claimed the same thing for that oversized blue-covered volume by Brown, et al.) Now Badger and Branchero has been added to the list.

In December, we attended the 48th Annual Meeting of AIChE in Detroit. And several times in the corridors of the Statler we overheard the same question being asked of academic friends, "Are you using Badger and Banchero?" Quite frankly, we were surprised at the many affirmative answers. "Yes," said one chemical engineering department chairman, "the book arrived late, but we've scheduled it and are now using it for unit operations this year. It's a little early to tell, but it seems to be much better than the old one."

Well we are back in New York and a copy of Badger and Banchero (with an uncracked back) sits on top of the desk. Our assignment: a review of this book—conceivably the book that will become the beginning bible of all chemical engineering undergraduates for the next several generations. We gulp twice and begin.

First off, you'll find no state-

Bookshelf

EDITED BY R. K. GITLIN

ments in this review that say "this book is a vast improvement over the old Badger and McCabe because . . . " The reason is simple. As explained in the first paragraph, we never studied Badger and McCabe.

Therefore, we can comment on Badger and Banchero with no preformed opinions. We report here only our fresh impressions of a brand new book.

Key to this book is in its preface. The authors assume that the beginning student in chemical engineering is ignorant of the equipment that is used in the chemical process industries, the general theory of any of the unit operations or the manufacturing processes in which these operations are used.

This is an excellent assumption. However, if the embryo chemical engineer is to be led gently to the green pastures of unit operations, why throw the hurdles of complicated language in his path? Badger and Banchero have been extremely careful in predigesting the engineering difficulties to make it easy for a beginner to swallow. But it's been wrapped in a high-brow English package in some places.

We found some of the very simple principles to be difficult in spots. And those spots turned out to be places where the authors let the English become too complicated. Fortunately, these rough spots are the exception rather than the rule.

Now we come to the problem of which unit operations to include, which to leave out and how much space ought to be devoted to each. This is becoming more and more a matter of personal opinion. Even the AIChE is no longer sure about which unit operations are the right ones and the Institute has scheduled a symposium at its next annual meeting to discuss this problem. Our personal opinion is that the authors devoted a disproportionate amount of space to evaporation (a subject on which W. L. Badger is recognized as an outstanding authority), size separation, crushing and grinding,

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conveying. We would have wished for some coverage of some others such as adsorption and ion exchange.

The emphasis in this book is on the practical side of unit operations and equipment. As the authors say, "We differ absolutely from those who think that when a differential equation is integrated the problem is completely solved. Consequently we have tried to emphasize actual detailed construction, rather than diagrammatic sketches or pictures of the outside of the equipment."

This approach is excellent. We did find, however, that carrying this emphasis into illustrations often gives them a black and unattractive look. In fact, many of them were hard to read.

There are problems for the students at the end of each chapter (except Conveying). But no answers.

Finally, there are those who will say that the book is too expensive ($9.50). Perhaps they're right. Consider, though, that the undergraduate will use it for at least a full year—and perhaps many more. Amortized over several years the book is a bargain. For you fellows in industry, you'll definitely want a copy of Badger and Banchero as a desk reference. If you can't justify the expense on a personal basis, be sure that you get your company or departmental library to buy it. You can't afford to do without it.—RFF

As Good As Ever

A SYSTEMATIC HANDBOOK OF VOLUMETRIC ANALYSIS. 13th ed. By F. Sutton. Revised by J. Grant. Butterworths Scientific Publications, London. 766 pages. 63s.

Reviewed by R. S. Browning, Jr.

The deservedly fine reputation enjoyed by this text during its ninety years of existence is in no way diminished by this new edition.

Revision of the section devoted to practice is very satisfactory. Methods have been added for various materials in keeping with modern emphasis; new

methods have replaced old where desirable. Discussion of technique has been extended to include more recent electrometric and micro-methods, among others.

Separation of this section from that devoted to a sound, though elementary, treatment of basic theory has resulted in enhanced value as both student text and working handbook. As in earlier editions, a valuable feature is the thorough documentation.

Perhaps insufficient space has been devoted to non-aqueous and complexometric titrations, but in view of the extensive coverage, not to mention the reasonable cost and good binding, this is a minor matter. The book is strongly recommended to all analytical chemists.

Old Standby, New Edition

PHYSICAL CHEMISTRY. By Farrington Daniels and Robert A. Alberty. John Wiley and Sons, New York. 679 pages. $6.50.

Reviewed by F. C. Nachod

Some books suffer strange fates. In 1913 Dr. Getman wrote "Outlines of Theoretical Chemistry" which became one of the most useful compendia for teaching this field. For the fifth and following editions he adopted Farrington Daniels as coauthor. Later on it became "Outlines of Physical Chemistry" by Daniels. Now Daniels again has adopted a coauthor, Alberty, and the "new" book has been christened "Physical Chemistry." One cannot help but wonder what happens once a chain reaction is started and when the senior author of the present text will retire from the cover, with a concomitant change in the title of the book.

Generations of chemists and chemical engineers have been nourished by Getman and Daniels and have worked out (mostly under bitter protest) problems which are part and parcel of sound education in physical chemistry. The present text is thoroughly revised, rewritten, amplified and streamlined. It contains much new material such as microwaves and enzymatic catalysis. The problems are new

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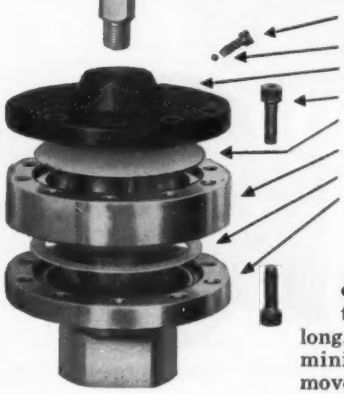

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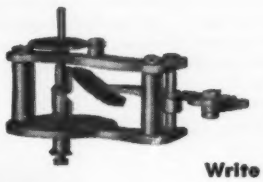

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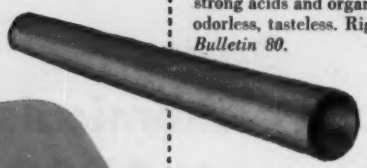

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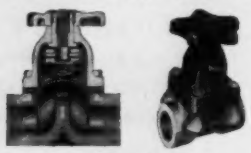

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and well thought out, based on actual laboratory data.

The text can be recommended unequivocally for teaching physical chemistry and certainly will prepare another generation of chemists and chemical engineers with the more sophisticated aspects of chemistry—just as the precursor texts have done.

Cookbook +

QUALITATIVE ORGANIC ANALYSIS. By A. McGookin. Reinhold Publishing Corp., New York. 155 pages. $4.50.

Reviewed by M. M. Tuckerman

In this excellent volume, the author offers the distillate of thirty years of teaching experience rendered delightfully readable by quotations, anecdotes and historical examples. Here is not the expected compilation of recipes and tables, but the methodology of analytical chemistry; how to think as well as what to do.

Topics include scientific method, functional group reactions, water solubility, hydrolysis and separation of hydrolysis products, records, drawing conclusions, criteria of compound purity and choosing derivatives.

The largest single section (45 pages) gives general properties of common types of organic compounds and useful derivatives of each type.

This well-indexed slim volume belongs in the library of the student who wishes something more than the usual cookbook and the professional analyst who wants a succinct and classified summary of the knowledge he should possess.

Plant Safety

SICHERHEIT IM CHEMIEBETRIEB. Econ-Verlag, Duesseldorf. 500 pages.

Reviewed by M. Wulfinghoff

This is a handbook, written in German, which gives detailed instructions on available means and techniques for protecting workers, equipment and buildings in chemical process plants against typical hazards.

The opening chapter discusses protection from fire and explosions. The second deals with mechanical failures; the third, with electrical hazards. The two final chapters cover general health hazards and the psychology of safe operation.

Sketches and tables, along with 45 photographs, aid in promoting a better understanding of devices and arrangements which will prevent accidents in the plant. The text is not only very readable but extremely practical throughout.

Third of a Series

CATALYSIS III—HYDROGENATION AND DEHYDROGENATION. Edited by Paul H. Emmett. Reinhold Publishing Corp., New York. 511 pages. $12.

Reviewed by F. C. Nachod

This volume covers a lot of ground. Such diverse topics as petroleum chemistry (hydrogenation of olefins), fertilizers (ammonia synthesis) and fat hardening (hydrogenation of glycerides) are treated competently by an international team of qualified authors.

Dr. Emmett ably continues the high standard laid down in the preceding two volumes of the series.

BRIEFLY NOTED

AN EVALUATION OF METHODS AND EQUIPMENT FOR THE ABSORPTION AND NEUTRALIZATION OF NITROGEN DIOXIDE BY SODIUM CARBONATE, SODIUM DICHROMATE AND POTASSIUM PERMANGANATE. 58 *pages.* $1.50. *By J. W. Fleming and G. L. Marine. U.S. Dept. of Commerce, Office of Technical Services, Washington, D. C.* The first 13 pages of this report (from the chemical and radiological laboratories of the Army Chemical Center, Maryland) cover pilot-plant experiments on the removal of toxic, gaseous, nitrous oxides formed from the decomposition of fuming nitric acid. Results of scrubbing HNO_3 with Na_2CO_3, $Na_2Cr_2O_7$ and $KMnO_4$ solutions are cited—along with specifications for column design and operation. The rest of the report consists of sample

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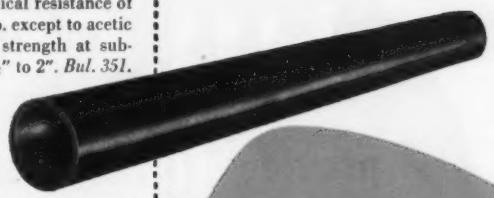

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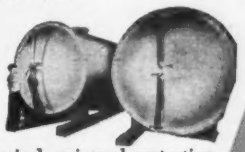

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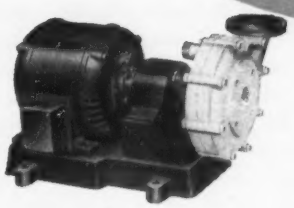

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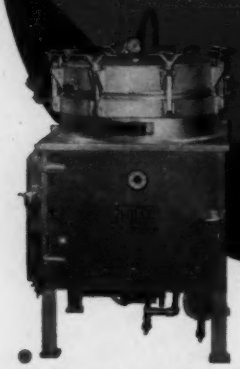

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ATOMIC AGE—THE TENTH YEAR. 21 *pages. International Review Service,* 15 *Washington Place, New York* 3, *N. Y.* Surveys the International Conference on the Peaceful Uses of Atomic Energy and analyzes the character and meaning of progress toward setting up the International Atomic Energy Agency. Fully documented, including an appendix with UN action and other background information. Available, along with other IRS analyses, on an annual subscription basis.

CHEMICAL ENGINEERING FACULTIES 1955-56. 49 *pages. American Institute of Chemical Engineers,* 25 *West* 45*th Street, New York* 36, *N. Y.* Lists schools offering chemical engineering instruction in U. S. and Canada. Included are the names and addresses of the institutions, whether or not the chemical engineering departments are accredited by AIChE, length of time required to complete undergraduate curriculum, available evening courses for undergrad and graduate work, members of departmental staffs, name of college or university placement officer.

ESL BIBLIOGRAPHY NO. 11. BIBLIOGRAPHY ON MACHINERY FOUNDATIONS; DESIGN, CONSTRUCTION, VIBRATION ELIMINATION. 25 *pages.* $2. *Engineering Societies Library,* 29 *West* 39*th Street, New York* 18, *N. Y.* Revised list of 175 annotated references to selected books and periodical articles published from 1924 to 1955. Among topics covered are theory, design and construction of machinery foundations; specific problems, e.g., heavy machinery foundations on unstable soils; vibration as related to foundations of hammers, oil engines, electrical machinery, turbines, compressors, pumps, etc.

GEOLOGY AND MINERAL DEPOSITS OF BARSTOW QUADRANGLE, SAN BERNARDINO, CALIF. 208 *pages.* $3 (*cloth-bound*), $2.50 (*paper-bound*). *By O. E. Bowen, Jr. and J. A. Pask. Division of Mines, Ferry Bldg., San Francisco* 11, *Calif.* Divided into two parts: geology and mineral deposits and thermal properties of ceramic materials in the Barstow quadrangle. Includes nine plates (geologic and economic maps of the area).

HANDBOOK OF INSECTICIDE DUST DILUENTS AND CARRIERS. 2*nd ed.* 233 *pages.* $4.75. *Edited by D. E.*

Weidhaas and J. L. Brann, Jr. Dorland Books, Caldwell, N. J. Lists classification of insecticide dust diluents and carriers and classified arrangement of companies according to types of diluents and carriers offered. Data includes botanicals, sulphur, tripolite, diatomite, calcium limes, magnesium limes, calcites, dolomites, gypsum, mica, vermiculite, talc, phyrophyllite, montmorrilonoid group, kaolinite group, attapulgite group, unidentified clays, phosphates, indeterminates, synthetics (producers, analyses, how packaged, how processed, price, etc.).

METALS HANDBOOK, 1955 SUPPLEMENT. 208 *pages.* $6. *American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.* Gives practical information on a wide variety of metal-working subjects requiring up-to-date reference material. Four main subdivisions are metals and applications, design and application, processing and fabrication, testing and inspection. Handbook contains 214 tables, 256 charts and 411 illustrations.

More New Books

CELLULOSE AND CELLULOSE DERIVATIVES. Part III. Edited by E. Ott and H. M. Spurlin. Interscience. $12.

COLLOID CHEMISTRY OF SILICA AND SILICATES. By R. K. Iler. Cornell University Press. $5.50.

GUIDA DEI PRINCIPALI PRODOTTI CHIMICI. By C. Ferri. Zanichelli.

HANDBUCH DER WERKSTOFFPRUFUNG. 2nd ed. By E. Siebel. Springer-Verlag. DM 118.50.

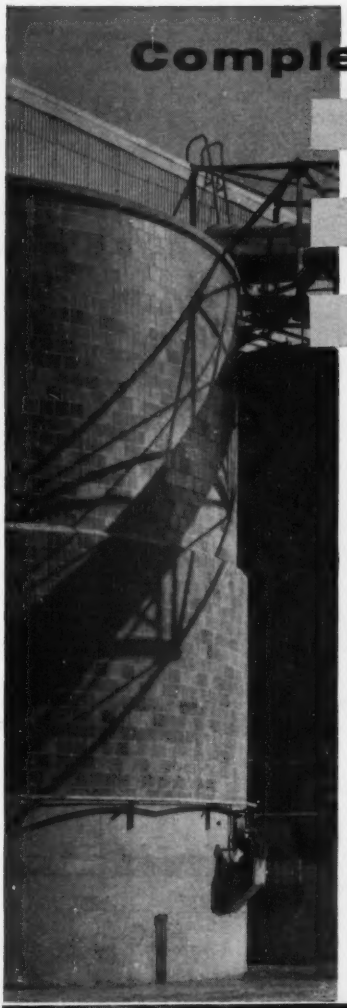
IMPROVING THE WORK SKILLS OF THE NATION. National Manpower Council. Columbia University Press. $3.50.

NUMERICAL MATHEMATICAL ANALYSIS. 3rd ed. By J. B. Scarborough. Johns Hopkins Press. $6.

PRINCIPLES AND PROBLEMS IN ENERGETICS. By J. N. Bronsted. Interscience. $3.50.

PROCEEDINGS OF THE SIXTH MEETING OF THE INTERNATIONAL COMMITTEE FOR ELECTROCHEMICAL THERMODYNAMICS AND KINETICS. Butterworths. 84s.

RESONANCE IN ORGANIC CHEMISTRY. By G. W. Wheland. Wiley. $15.



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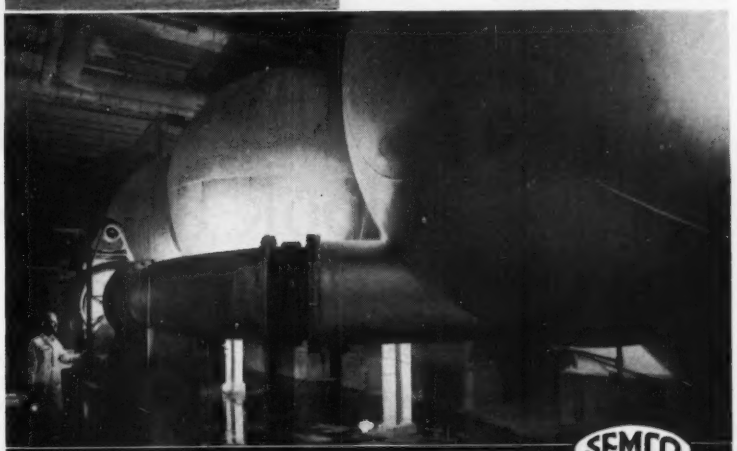

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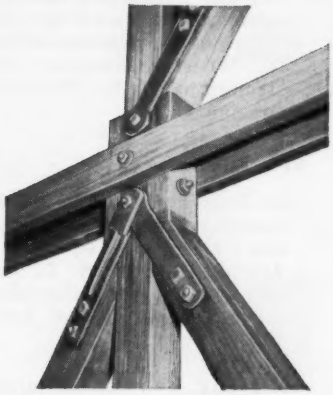

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"Answers to the 15 Questions About Pritchard Induced Draft Cooling Towers." It offers tips on evaluating cooling tower bids, tells you factors to consider in choosing a cooling tower. Send for your complimentary copy today on your company letterhead.

INDUSTRY'S PARTNER FOR PROGRESS

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OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 517, 4625 Roanoke Parkway
Kansas City 12, Missouri

COOLING TOWERS * GAS & AIR TREATING EQUIPMENT
REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

THIS MONTH'S

Firms in the News

EDITED BY F. ARNE

New Names

Puget Sound Sheet Metal Works, Seattle, Wash., has changed its name to Puget Sound Fabricators, Inc. for better identification of its diversified operations including custom fabrication of steel, stainless, aluminum, nickel and other metals.

H. K. Porter Co., New York, has changed the name of its Watson-Stillman Fittings Division to W-S Fittings Division.

New Companies

Mallory-Schwarzkopf Metals, Inc. has been formed by P. R. Mallory & Co. and Schwarzkopf Development Corp. to produce and fabricate refractory metals for the electronic, chemical and aircraft industries. A plant is planned for Huntsville, Ala., with initial operations scheduled for late 1956.

Plessey Development Co. Ltd. has been formed by Plessey International Ltd., Ilford, England, to control the establishment and development of a number of new Plessey enterprises in Great Britain. The new company will give particular attention to providing and blending American abilities in design and production with Plessey's extensive production capacity.

Mineral Aggregates Corp. has been formed in Denver to process and market a mineral ore as a soluble soil amendment. The firm has leased a hammer mill at Salida, Colo., to process ore mined nearby which contains about 37% sulfate and 26% calcium with some magnesium, potassium, phosphorous, free sulfur and nitrogen in a compound that is 92% soluble in water.

Dorr-Oliver-Long Ltd. has been formed as a result of the integration of the Canadian operations of Dorr-Oliver Inc., Stamford, Conn., and E. Long Ltd. of Orillia, Ont. Headquarters will be located in Orillia with the former Toronto office of Dorr-Oliver and the Vancouver office of E. Long operating as divisional sales offices.

Industrias Consolidadas has been formed in Venezuela as a new manufacturing and sales subsidiary of Diversey Corp., Chicago. A plant to manufacture sanitary specialties will be located in Antimino, a suburb of Caracas.

New Lines

Hays Corp., Michigan City, Ind., manufacturer of power and process instrumentation has added a line of digital recording equipment through its recent annexation of Metrotype Corp., Summit, Ill.

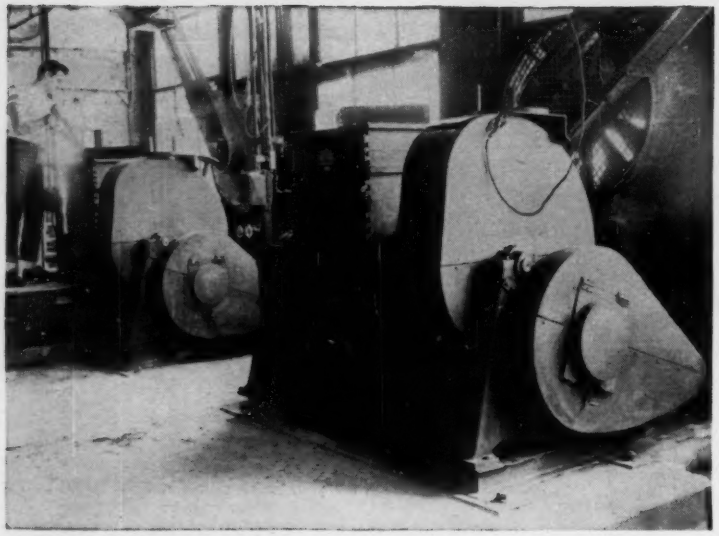
Perkin-Elmer Corp., Norwalk, Conn., has added fully-automatic, high-speed ultraviolet recorders to its line of laboratory instruments. The addition resulted from acquisition of Warren Electronics, Inc., Bound Brook, N. J.

New Representatives

Bird Machine Co. has appointed José M. Cabrera, Mexico City, as representative for the sale of pressure filters to all plants in that territory with the exception of those in the vegetable oil industry.

Armstrong Machine Works, Three Rivers, Mich., manufacturer of heating and cooling equipment, has appointed Award Engineering Co., Buffalo, N. Y., as its district representative in western New York and Power Specialties Co., Arlington, Mass., to handle New England.

Sealol Corp., Providence, R. I., has appointed Evan L. Price Co., New York, N. Y., as its



"it's three ways better at B. F. Goodrich"

#1 *It's faster* . . . delivers more production per hour.

#2 *It's efficient* . . . assures thorough dispersion of quality rubber doughs and cements.

#3 *It's safe* . . . special CO_2 seal on stuffing boxes (only 4 to 10 lbs. pressure) permits elimination of air from mix while protecting product from contamination by lubricants.

DAY IMPERIAL MIXER . . . built for heavy duty, engineered for precision, it incorporates many advanced engineering features to assure you high production at low cost. For complete details write for Bulletin 600.

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in mixing equipment **DAY** *means longer life span*

THE J. H. DAY COMPANY
INCORPORATED
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Division of Cleveland Automatic Machine Company

Quality equipment for baking, paint and varnish, printing ink, chemical, rubber, pharmaceutical, cosmetics, paper and pulp, explosives, food, ceramics, candy, soap, sugar and milk products.

Eastern Canada: Brantford Oven & Rack Co., Ltd., Brantford, Ontario
Western Canada: British Canadian Importers, Vancouver, British Columbia
Mexico: T. de la Pena e Hijos, S.A., Nazas 45-A, Mexico 5—D.F.

sales representative in the New York Metropolitan area.

Barber-Colman Co., Rockford, Ill., has announced the appointment of Grant Edgel Co. as exclusive representative for Wheelco Industrial Instruments in the Portland, Ore., area.

New Locations

Corn-Dubilier Electric Corp., manufacturer of electrical and electronic equipment, South Plainfield, N. J., has moved its Midwest sales office to 5247 West Diversey Ave., Chicago.

Oster Mfg. Co., manufacturers of pipe and bolt threading machinery and material handling equipment, has moved to a new plant on East 289th St. in Wickliffe, Ohio.

Chemo Puro Mfg. Corp. has moved its plant and executive offices from Long Island City, N. Y., to 148-182 Doremus Ave., Newark, N. J.

General Controls Co., Glendale, Calif., manufacturer of automatic controls, has moved its Kansas City, Mo., district office to 2904 Oak St.

Schwartz Chemical Co. has moved part of its offices, labratories and plant from their present locations in Burbank, Calif., and Manhattan to Long Island City, N. Y.

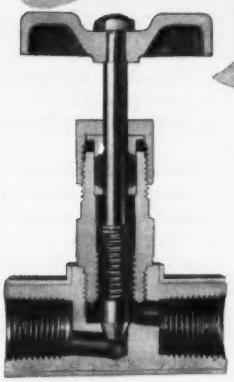
Minerals & Chemicals Corp. of America has moved its entire Philadelphia, Pa., and Metuchen, N. J., operations to its new general offices at Menlo Park, N. J.

New Facilities

Richfield Oil Corp. is scheduled to complete a $250,000 engineering building at its Watson, Calif., refinery by August 1956.

Borden Co., New York, has acquired the American Resinous Chemicals Corp. of Peabody, Mass., and Reslac Chemicals, Inc., of Chicago. In addition, the company's

Now... the Marsh Needle Valve in 416 Stainless Steel throughout!



All the superior dependability of the Marsh Needle Valve... with all the corrosion resistance and durability of 416 Stainless Steel! Guaranteed for working pressure up to 10,000 psi; equally efficient at any lower pressure. Globe and angle patterns with double female connections in ⅛" to 1" size range. Also globe and angle valves with male inlet, female outlet, ¼" and ½" sizes.

For complete details, write for Bulletin No. HV-2.

MARSH INSTRUMENT CO.
Sales Affiliate of Jas. P. Marsh Corp.
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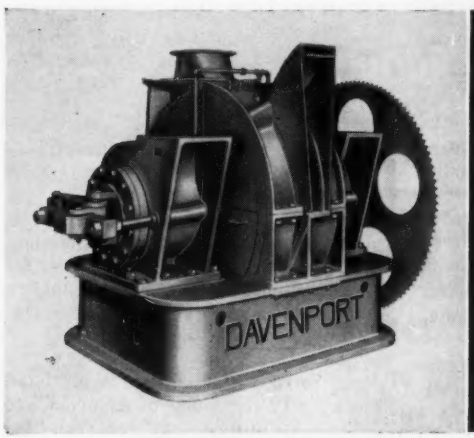
MARSH
"THE STANDARD OF ACCURACY"

Marsh Instrument & Valve Co. (Can.) Ltd., 8407 103rd St., Edmonton, Alta., Can.



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PRESSING – DRYING and COOLING Equipment

Continuous DeWatering Presses

ROTARY DRYERS
Steam Tube, Hot Air and Direct Fire

Atmospheric DRUM DRYERS

ROTARY COOLERS
Water and Air

The *New* 1B "DAVENPORT" Continuous De-Watering Press

This new press was designed and built to withstand the extremely heavy service required in the Pulp and Paper Field. This same press can be adapted to many other products that have a fibrous nature. This press can also be readily adapted to products having a highly corrosive element.

Let our engineers consult with you on your Pressing, Drying, and Cooling problems, or send for complete Catalog A.

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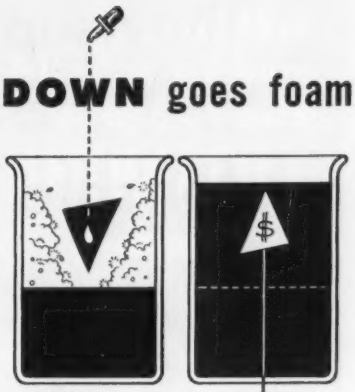
DAVENPORT, IOWA U. S. A.



DOWN goes foam

UP goes production

with Dow Corning Silicone Defoamers

Dow Corning Antifoam A* Compound and Antifoam A emulsions are the most efficient and versatile foam killers ever developed. Thousands of successful applications prove they increase productive capacity, reduce processing time, eliminate the waste and fire hazard of boil-overs. And all three, Antifoam A Compound[1]—Antifoam A Emulsion—Antifoam AF Emulsion[2], are effective at low concentrations. For example:

One Ounce of

. . . Antifoam A Compound kills foam in
◊ 35,000 lb
Vitamin B_2

. . . Antifoam A Emulsion kills foam in
◊ 1,245 lb
textile sizing

. . . Antifoam AF Emulsion kills foam in
◊ 2,075 lb
chocolate syrup

[1] Permissible in food processing at concentrations up to 10 ppm.
[2] Permissible in food processing at concentrations up to 32 ppm.

free sample

Test these versatile silicone defoamers at our expense.

SEND COUPON TODAY!

DOW CORNING SILICONES

Dow Corning Corporation
Midland, Mich., Dept. 260A

Please send me:
☐ Booklet on Silicone Defoamers; FREE sample of ☐ Antifoam A Compound ☐ Antifoam A or ☐ AF Emulsion;

NAME _____
COMPANY _____
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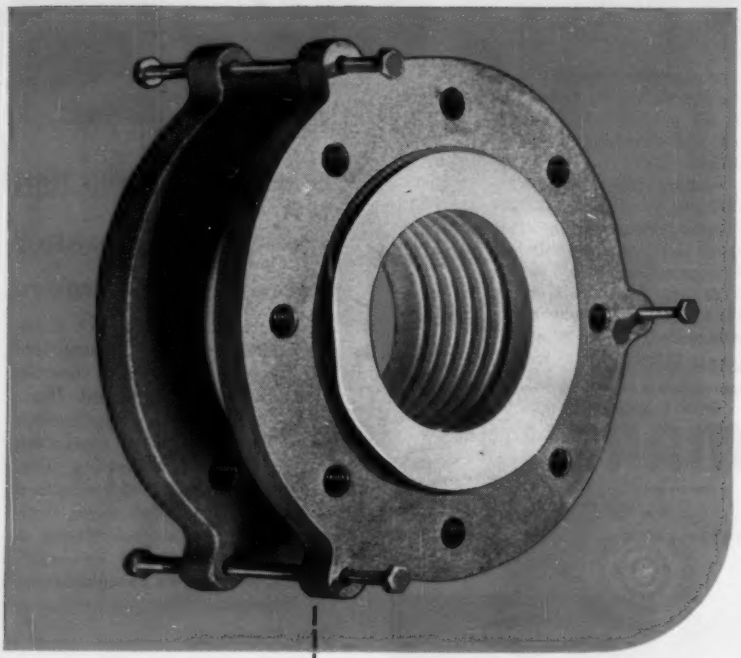
® T M DOW CORNING

they supply the "GIVE and TAKE" for safe piping seals



made of du Pont TEFLON

Chemiseal Expansion Joints and Flexible Couplings—Made of TEFLON—protect costly chemical piping, usually low in impact strength.

They absorb shock, vibration, thermal expansion and contraction. Correct misalignment. Connect unlike piping ends and nozzles. Eliminate gaskets, adaptors and slip joints. Are impervious to *all* chemicals excepting only molten alkali metals, fluorine under pressure and chlorine trifluoride.

All TEFLON Expansion Joints and Flexible Couplings are pressure tested at the plant . . . and flexural tested, too, for special requirements.

Write for Bulletin EJ-1155 or ask your U. S. Gasket-Belmont Packing Distributor.

UNITED STATES GASKET CO.
CAMDEN 1, NEW JERSEY

U.S. GASKET • BELMONT PACKING

FIRMS . . .

chemical division has opened a new service laboratory in Los Angeles for Pacific Coast producers of water-based paints.

Standard Oil Co. of British Columbia Ltd. has put West Canada's first platinum catalytic reformer on stream at its refinery near Vancouver.

Chas. Pfizer & Co. will double production capacity for animal feed supplements at Terre Haute, Ind., with plant additions to be completed this June.

Shawinigan Resins Corp., Springfield, Mass., has just completed facilities which more than double its research facilities.

Pontiac Eastern Corp. is building an $18 million refinery in Lamar County, Miss. Completion is set for early next year.

American-Marietta Co., Chicago, has acquired the Southern Cement Co. which has two manufacturing plants in Birmingham, Ala.

Mobay Chemical Co. has just opened research laboratories at the site of its plant in New Martinsville, W. Va.

Skeist Laboratories, chemical consultants to the polymer industries, have just opened a new laboratory in Newark, N. J.

Vitro Laboratories, a division of Vitro Corp. of America, are building new research facilities in Silver Spring, Md., to be completed in 1957.

Battelle Memorial Institute has just completed a power reactor development laboratory near Columbus, Ohio. Another laboratory, one containing a "swimming pool" type research reactor to evaluate fuels is expected to go into operation in June.

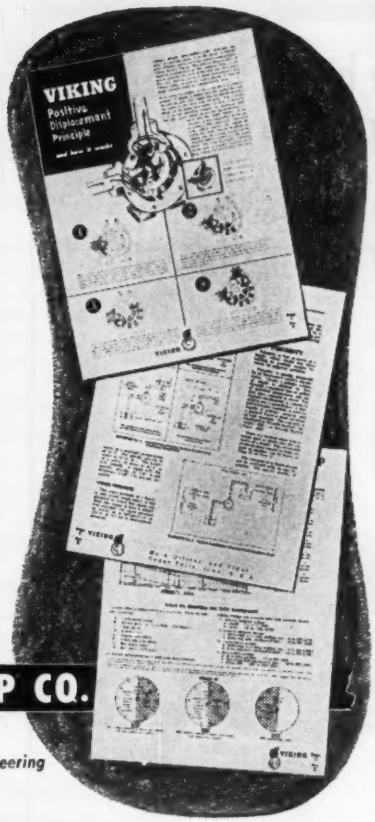
Haskell Chemical Co., Richmond, Va., manufacturer of cellulose coatings, plans to

MORE HELP with your

PUMPING PROBLEMS

NEW 40 page VIKING Engineering Manual

A new 3-part, 40-page engineering manual including Viking rotary pump fundamentals, the 10 steps in selecting a Viking pump, and a special engineering section will help you in choosing the right rotary pump for your job.

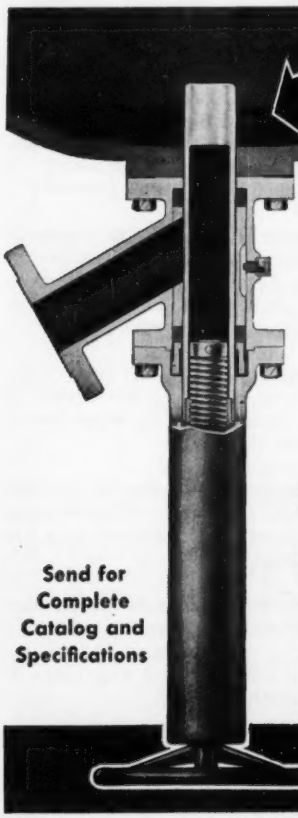


This manual is free upon request. Write today for Manual K c.

VIKING PUMP CO.

Cedar Falls, Iowa

See our catalog in Chemical Engineering Catalog



NO RODDING NECESSARY!

Strahman RAM TYPE Drain Valves

The Only Drain Valve That Cannot Clog Up!

In the closed position the piston or ram extends up into the tank, preventing plugging of the outlet.

In the open position with piston fully retracted, there is no resistance to flow of materials drained from the tank.

Made in any cast metal to meet your requirements.

Designed for bolting to existing flanges. For special adaptations and for jacketed vessels, adaptor pads are available.

Send for Complete Catalog and Specifications

STRAHMAN VALVES, INC.,
16 HUDSON STREET, NEW YORK 13, U.S.A.

. . . no other filtering medium compares with ANTHRAFILT

Trade Mark Reg. U. S. Pat. Off.

Modern, All-Purpose* ANTHRAFILT *Stands Alone as the One Filtering Medium that is* BEST *for All Types of Filters

Years of efficient and economical use in every type of filter plant has made Anthrafilt the standard of excellence in the filtering medium field.

ANTHRAFILT is made from selected Pennsylvania Anthracite, low in ash, high in anthraxlon, low in friability, correctly shaped and sized for best overall results in filtration.

switch to* ANTHRAFILT *for more efficient and economical filtration

ANTHRAFILT provides greater capacity . . . longer filter runs . . . cleaner washings at lower cost . . . removes entrained turbidity from industrial process solutions or wastes.

Write today for full details and recommendations to:

PALMER FILTER EQUIPMENT CO.
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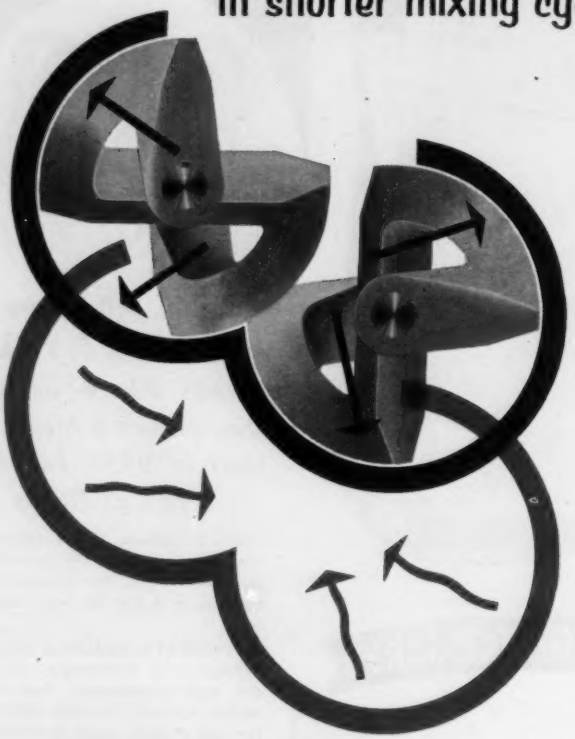
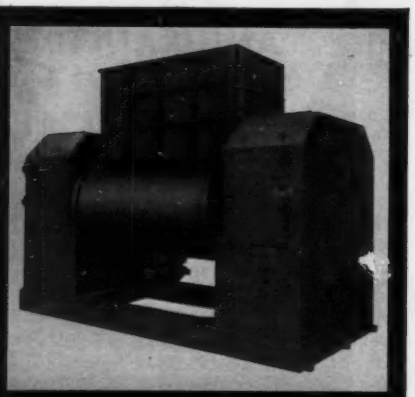
Representing
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Bldg., Wilkes-Barre, Pa.

From this unique bowl
...COMPLETE DISPERSION
...MAXIMUM HEAT TRANSFER
in shorter mixing cycle





READ STANDARD
CORPORATION

The unique shape of this mixer bowl presents a greater ratio of heated surface to the mix. Close clearances between the mixer arms and shell eliminate build-up of materials, facilitating heat transfer.

Overlapping sigma-arm mixing action exposes new surfaces and breaks down the entire mass with each rotation, eliminating peak loads and producing a homogenous mix in a short mixing cycle.

Available in capacities up to 750 gallons.

BAKERY-CHEMICAL DIVISION, York, Pennsylvania

FIRMS

build a $70,000 plant in Richmond to make synthetic resins.

National Starch Products Inc., New York, has opened a rubber, and other solvent adhesives, plant at Plainfield, N. J.

B. T. Babbit, Inc., has bought up Cameo Corp., Chicago, and will operate it as a subsidiary. Cameo makes a copper cleaner.

Bowaters Southern Paper Corp. plans to spend $4 million for equipment for production of newsprint pulp from local hardwoods in Calhoun, Tenn. At the same site, a $5 million mill for making wallboard will be built.

Geigy Chemical Corp. is building a $3 million laboratory and headquarters office near Hastings, N. Y.

Armour Laboratories have opened new pilot plant facilities in Kankakee, Ill., to provide technical assistance to pharmaceuticals manufacturers.

Ingram Oil & Refining Co. has just completed $1 million in new facilities at its **Meraux,** La., refinery including a 3,000 bbl. per day platformer.

Kaiser Aluminum & Chemical Corp. will begin operation of a $4 million basic refractory brick plant at Columbiana, Ohio, this summer.

Arthur D. Little, Inc., Cambridge, Mass., has opened a branch office in Washington. D. C.

American Marietta Co. of Canada will build a $350,000 resin plant in Edmonton, Alta., in 1956.

Crown Zellerbach Corp., San Francisco, has set mid 1956 for completion of $12 million paper mill and bag plant at Antioch, Calif.

Courtaulds (Canada) Ltd. has decided to expand by 50% its capacity to produce vis-

SPRAYING SYSTEMS CO.
SPRAY NOZZLES
performance-proved
for every operation
Take advantage of the wide choice of spray nozzle types and capacities supplied by Spraying Systems to meet your needs exactly. Actually tens of thousands of precision, standard spray nozzles to choose from. Every kind of spray pattern.
STRAINERS . . . high efficiency line strainers in all standard capacities.
write for catalog 24
A complete 48 page catalog with specifications on all standard and pneumatic atomizing nozzles. The most complete spray nozzle reference manual ever printed.
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1896 ®

The importance of difference . . .

Whatever will make our chemicals do their work better, more economically, and thereby more satisfactorily for Oldbury customers . . . this is the "difference" we seek while maintaining product uniformity at the highest possible level. Such "*difference*" as this is important to all concerned . . . customers who must depend on Oldbury products . . . and ourselves as producers with a reputation for reliability to maintain.

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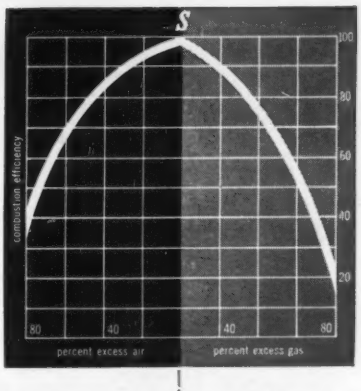


Even a little excess air hurts combustion efficiency. | *Excess gas decreases combustion efficiency even more.*

HIT THE PEAK IN BURNER EFFICIENCY

Another reason you get the most heat per penny spent for fuel with 'Surface' burners: they give you peak combustion efficiency. Conventional burners, with excess air or gas, throw away much of your potentially usable heat. With 'Surface' Automatic Proportioning, the precise amount of air required for complete combustion is constantly mixed with the gas.

When your processes require reducing, oxidizing, or neutral atmosphere, you can easily adjust a 'Surface' inspirator to give the correct gas-air ratios uniformly over the entire operating range.

On top of that, you get peak operating efficiency with 'Surface' One-Valve Control, which simplifies burner operation, minimizes human error.

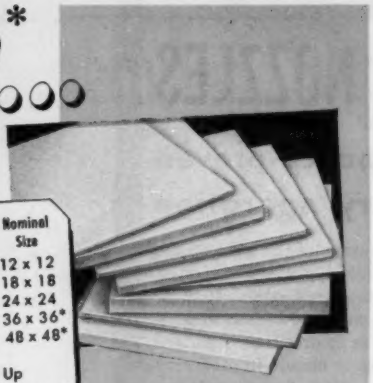
Write for Bulletin H55-5 to find out how 'Surface' burners can help you.

Surface
HEATING EQUIPMENT

SURFACE COMBUSTION
CORPORATION, TOLEDO 1, OHIO
Also makers of Janitrol automatic space heating and Kathabar humidity conditioning

Teflon*...

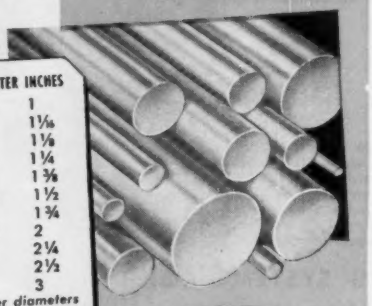
Your Best Source Is JOHN CRANE



Thickness Inches	Nominal Size
1/16	12 x 12
3/32	18 x 18
1/8	24 x 24
3/16	36 x 36*
1/4	48 x 48*
3/8	
1/2 & Up	

* Can be furnished in 1/2 sheets

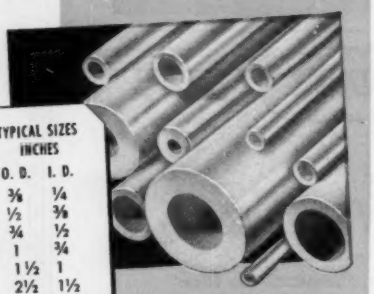
SHEET



DIAMETER INCHES	
1/4	1
5/16	1 1/8
3/8	1 1/8
7/16	1 1/4
1/2	1 3/8
9/16	1 1/2
5/8	1 3/4
3/4	2
7/8	2 1/4
	2 1/2
	3

Other diameters on specification

ROD



TYPICAL SIZES INCHES	
O. D.	I. D.
3/8	1/4
1/2	3/8
3/4	1/2
1	3/4
1 1/2	1
2 1/2	1 1/2
3	1 3/4

TUBING

HERE'S WHY: You can order in quantity and in a wide variety of sizes—and be certain of complete uniformity throughout. Our strict density control assures you thoroughly non-porous Teflon—free from any flaws which might possibly affect your end use or product. Dimensions are accurate to your most critical tolerances—no rejects, waste of material or loss of time. You get product purity—Teflon at its best in every one of its remarkable characteristics. Delivery is prompt—you get the quantity you want when you want it.

Since the availability of Teflon, "John Crane" engineers have worked with Industry to successfully solve innumerable problems and develop new applications. *You can benefit from their experience and know-how.*

Characteristics of Teflon

CHEMICAL
Completely inert.

ELECTRICAL
Very high dielectric strength.
Extremely low power factor.

THERMAL
Temperature range
−300° to +500° F.

MECHANICAL
Strong, flexible, weather resistant.

LOW COEFFICIENT OF FRICTION
Absolutely non-stick.

* DuPont Trademark

Request full information and ask for our bulletin, **The Best in Teflon.**

CRANE PACKING CO.,
6451 Oakton St., Morton Grove, Ill.,
(Chicago Suburb)
In Canada Crane Packing Co., Ltd., Hamilton, Ont.

JOHN CRANE CRANE PACKING COMPANY 38 YEARS INDUSTRIAL PROGRESS

FIRMS . . .

cose staple fiber at its Cornwall, Ont., plant. To be completed by the end of 1956, the increase will boost capacity to 45 million lb./yr.

Sun Oil Co. is about to open a new alkylation unit at its Toledo, Ohio, refinery which will use sulfuric acid as a catalyst to produce alkylate for blending into motor gasoline.

Dow Chemical Co. is building a $6.5 million copper leaching plant near the Israel seaport of Elath. To be operated by Israel Mining Industries, the plant will produce 1,500 tons per day of "cement copper" containing 75% of metallic copper concentrate.

U.S.I. Industrial Chemicals Co. has built two new combination alcohol denaturing plants: a 12 million gal. per year unit at Tuscola, Ill.; a 10 million gal. per year unit at Newark, N. J.

Chase Chemical Corp., Pittsburgh, Pa., has acquired Pruett-Schaffer Chemical Co., manufacturer of railroad and industrial finishes.

General Tire & Rubber Co. has formed a flooring division and developed a new vinyl flooring product to be known as "bolta-floor." The new division's manufacturing operations will be centered at General's Jeannette, Pa., plant.

Oak Ridge Institute of Nuclear Studies will spend $6 million to build a permanent headquarters at Oak Ridge.

Fuller Co., manufacturer of pneumatic materials handling equipment, has completed a new engineering building at Catasauqua, Pa.

Strong Cobb & Co. has increased production capacity of the tableting and coating departments of its Cleveland plant by 20%.

Trubek Laboratories, East Rutherford, N. J. manufacturer of organic chemicals.

Where a few POUNDS mean more than a few YEARS

Safety and *long life* are prime considerations in the design of Harrisburg High Pressure Gas Cylinders. Yet they are as light as sound engineering permits, without a pound of excess weight. True, we might shave off a few more pounds, but it would entail shaving off more than a few years from their life expectancy.

Industry expects a quarter-century or more of safe service from compressed gas cylinders, based on long experience with the Harrisburg product. Industry can continue to do so, for Harrisburg Cylinders will always be built for a long and safe future. Send for prices and literature.

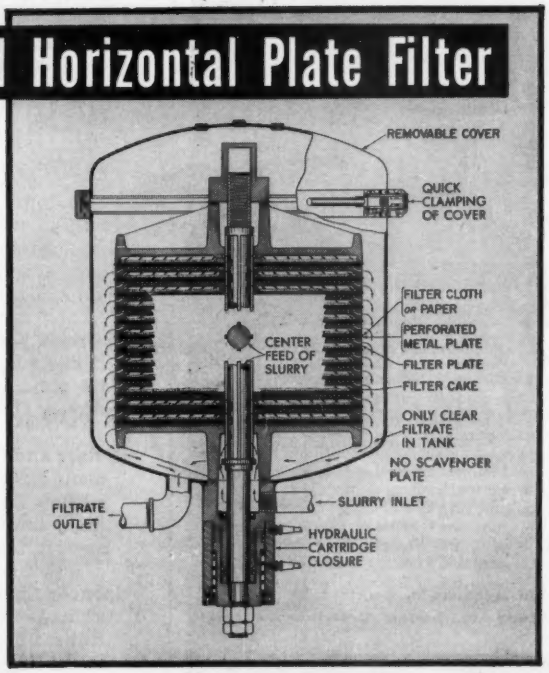
More than a century in Harrisburg

Harrisburg Steel
CORPORATION
HARRISBURG 3, PENNSYLVANIA

Enclosed Horizontal Plate Filter

Leakproof
Vaporproof
•
for Batch or Continuous Operation
•
Cake stays in place even when run is interrupted
•
Easy to clean

Write for Catalog



T. SHRIVER & COMPANY, Inc.

Filter Presses • Filter Media • Diaphragm Pumps

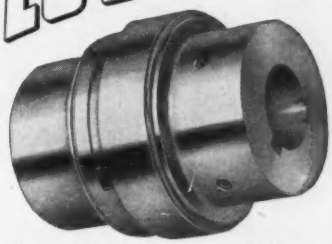
802 Hamilton St., Harrison, N. J.

Sales Representatives in Decatur, Ga.–Houston, Tex.–St. Louis, Mo. San Francisco–Montreal–Toronto

15 YEARS SERVICE WITH ONE SET OF CUSHIONS

. . . actual report on

LOVEJOY



Flexible Couplings

Up to fifteen years maintenance-free service is not unusual with Lovejoy lubrication-free flexible couplings.

Performance like this is practical proof of these soundly engineered features:

SIMPLE, RUGGED CONSTRUCTION
Fewer parts. No intricate mechanisms. Nothing to lubricate.

LOAD TRANSMITTED BY CUSHION COMPRESSION
No wear on the metal jaws.

DOUBLE-LIFE CUSHIONS
One half of the cushions act as idlers—except on reversible loads. A quick interchange provides a new set of cushions. This can be done without dismantling the coupling.

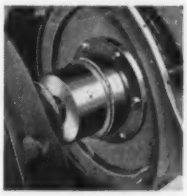


Illustration at right shows a Lovejoy Type CF flange-mounted coupling. Rated at 160 hp., 800 rpm., this space saver connects drive shaft between diesel power unit and generator.

You can get Lovejoy performance for your application.

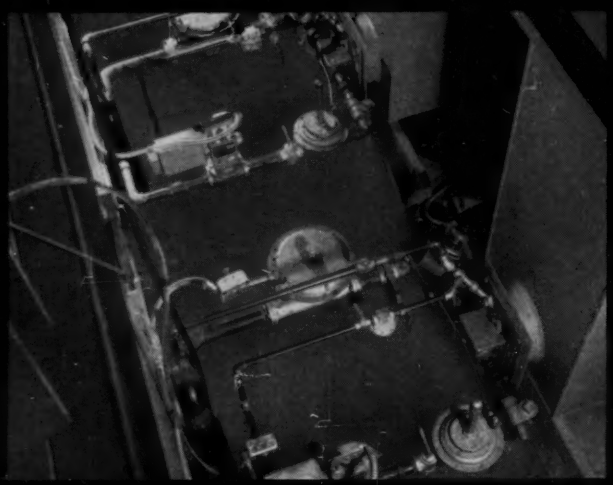
Let us know your requirements or request complete-line catalog.

LOVEJOY FLEXIBLE COUPLING CO.

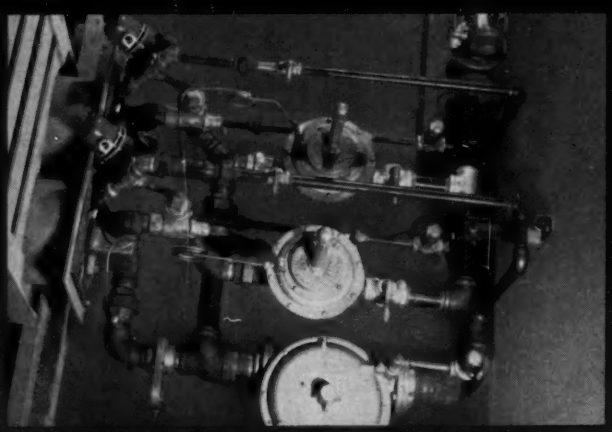
4961 W. LAKE STREET • CHICAGO 44, ILLINOIS

Mfrs. of Flexible Couplings, Variable Speed Pulleys and Transmissions, Motor Bases and Universal Joints.

Eclipse "Process Designed"
Combustion Equipment



-fires immersion heating tanks



for finishing aluminum!

Here are two of six Eclipse Combustion Assemblies designed for heating tanks used for putting a hard oxide finish on aluminum by Cupples Products Company, St. Louis, Missouri—leading manufacturer of aluminum windows and curtain wall. The assemblies include Eclipse nozzle mixing gas burners, combustion safeguards, zero gas governors, gas cocks, safety shut-off valves, blast gates, and automatic temperature control valves. Tanks are pit-mounted and burners are fired into large, 30 ft tubes for immersion heating of solutions for cleaning, etching, and sealing. If you have process heating problems, Eclipse will design combustion assemblies to meet your special requirements. Write for catalog describing Eclipse Burners, Blowers, Mixers, and Valves—the most complete line of combustion components available from any *one source!*

ECLIPSE FUEL ENGINEERING CO., 1121 Buchanan St., Rockford, Ill.
Eclipse Fuel Engineering Co. of Canada, Ltd., Toronto, Ontario

Eclipse PROCESS HEATING

FIRMS . . .

has acquired Truland Chemical Co., Union, N. J. Operations of the latter—custom reclamation or purchase of organic chemical byproducts—will be moved to East Rutherford.

Bart Laboratories Co., Belleville, N. J., has just completed a new plant to house its precision precious metals plating facilities.

Rockwell Mfg. Co. has quadrupled its central research and engineering floor space at Pittsburgh, Pa., and doubled the staff there.

Hercules Powder Co. has established new sales offices at Detroit and Minneapolis for its synthetics department.

Bogue Electric of Canada, Ltd., has opened new production and administrative headquarters near Ottawa, Canada. The firm makes power supplies, control systems and electronic components.

American Cyanamid Co. has opened a Cleveland sales office for the refinery chemicals department of its industrial chemicals division.

Texas Asphalt and Refining Co., Houston, is building a $1 million, 2,500 bbl. per day asphalt plant in Pasadena. June is the scheduled completion date.

Phillips Chemical Co. has established a new district office for its plastics sales division at Akron, Ohio.

G. Barr and Co., Chicago aerosol manufacturer, has started up its new Los Angeles plant for both refrigerated and pressure filling.

Spencer Chemical Co. will erect a new research center in Kansas City, Mo. Completion is set for spring of 1957.

Farbenfabriken Hoechst has acquired Anorgana GmbH., Gendorf, Bavaria, plastics manufacturer. It has also reached an agreement with

AUTO-LITE

for

EYE LEVEL READING

Auto-Lite Temperature Indicators are ideal for use in processing and storage rooms, and for installation on equipment where temperature indication is desirable.

Model F-1 (illustrated) is available with maximum visibility dial; choice of temperature ranges from minus 60°F to plus 750°F; flexible tubing for remote reading or rigid stem for direct mounting. Adjustable electrical alarm contacts slightly higher. Priced from $22.

Send for new catalog describing Auto-Lite Temperature Indicators and Recorders.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

TEMPERATURE INDICATORS AND RECORDERS

METAL FABRICATING

better by LITTLEFORD

Nickel pipe fabricated for the chemical industry

More accurate and faster metal fabricating is yours at Littleford . . . because (1) our engineers work closely with your engineers. (2) 175,000 sq. ft. of modern plant and equipment are devoted to the production of your tanks, bins, vats, troughs, carts, ducts and special units. In addition, you get the advantage of over 73 years experience in metal fabricating including stainless steel, aluminum, nickel and monel. For prompt estimates, send your blueprints to Littleford Bros., 417 E. Pearl St., Cincinnati 2, Ohio.

What's your
GATE VALVE
MORTALITY

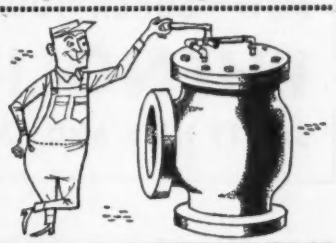
on installations requiring frequent opening and closing?

REPLACE *them*
with **G-A FLOWTROL VALVES**

✓ *Use the Angle Body and Save the Price of an Elbow Fitting*

✓ *Built to Last a Lifetime*

✓ *Operates with Finger Pressure*



HERE'S PROOF:

One of America's large railroads had a 6″ gate valve installation that operated on the average of 55 times a day. In addition to frequent repairs, this valve had to be entirely replaced every 3 months.

In the Fall of 1947, this valve was replaced with a 6″ G-A Flowtrol Valve. Now—more than 7 years later—this valve is still operating perfectly and not one parts replacement has been made!

Want to know more about this unique valve? Write for Bulletin W-8A today.

GOLDEN ANDERSON
Valve Specialty Company
1203 RIDGE AVE., PITTSBURGH 33, PA.
Designers and Manufacturers of
VALVES FOR AUTOMATION

LOOK TO WILLSON
for another new development in head protection!

NOW—SUPER-TOUGH
PHENOLIC
SAFETY HATS AND CAPS

FROM THE WILLSON RESEARCH CENTER now comes the "Phenolic" line of scientifically designed safety headgear that meets all specifications with ease!

In this Super-Tough line are safety developments so outstanding that you'll find it offers unequalled value. For instance, the famed "geodetic suspension" and the unique pneumatic headband are obtainable in both adjustable *lace-in* and *snap-in* types of hats and caps.

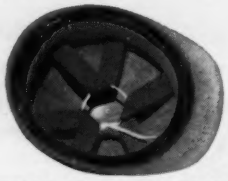
Ask your Willson distributor to demonstrate the heavy duty Phenolic line that combines comfort and maximum head protection. Or write for latest "Super-Tough" bulletin describing them in detail.

Strongest Made!

See how it's built up from 24 individual die cut pieces into a sturdy Phenolic pattern that withstands repeated 80-foot-pound drop ball tests without even fracturing!

LACE-IN SUSPENSION

Both hats and caps are available with convenient lace-in suspension feature. Easily adjusted for snug comfort to any head size.



SNAP-IN SUSPENSION

Handy Center-Tie snap-in type suspension is also obtainable in Super-Tough hats and caps. *Willson's exclusive patented "Geodetic Suspension" and Pneumatic Headband can be had in any style!*

Over 300 safety products carry this world-famous trademark

WILLSON PRODUCTS, INC.
106 Thorn St. Reading, Pennsylvania

Rheinpreussen A.G. fuer Bergbau und Chemie through which it gets the production, distribution and patent rights on all Rheinpreussen pharmaceuticals.

American Radiator & Standard Sanitary Corp. has dissolved its wholly-owned subsidiary, Kewanee-Ross Corp. To continue its operations, the company has formed two new divisions: the Kewanee boiler division; the Ross heat exchanger division.

Dow Chemical Co. has absorbed its wholly-owned subsidiary, Brazos Oil and Gas Co. into the parent organization. As a division, Brazos will continue exploration for the production of oil and gas for Dow use.

Johns-Manville Corp. plans to spend $25 million on capital expansion and improvements in 1956. Among the company's new projects: A $4 million Marrero, La., plant with an annual capacity of 35 million sq. ft. of asphalt and vinyl asbestos tile; a synthetic silicates plant nearing completion in Lompoc, Calif.

Bemis Bro. Bag Co., St. Louis, Mo., has started up its first paper specialty operation on the West Coast at its Wilmington, Calif., plant.

Inland Testing Laboratories, Chicago, has completed new branch laboratories at Dayton, Ohio.

Aluminum Co. of America will complete next spring a $4 million addition to its Alco, Tenn., aluminum alloy sheet rolling equipment.

Shell Chemical Corp. is building facilities to produce cold high solids latex at its Torrance, Calif., synthetic rubber plant.

University of Southern California has started construction of a $250,000 research building for chemical and petroleum engineering.

Remarkable!

Chempro's new Style FM-4 bearings, bushings, washers, etc., have given remarkable service in pumps, mixers and reactors operating under highly corrosive conditions. Made of Teflon,* glass, graphite and an inert lubricant, Style FM-4 bearings and bushings are hard, corrosive-resistant, have a low coefficient of friction, and compare favorably in wearability with those made of metal.

FOR EXAMPLE:

If other bearing materials on your pumps have failed due to corrosion...use **FM-4.**

If the shaft bearings on your mixers and reactors must be compatible with the product ...use **FM-4.**

Also available in rod, tube and cylindrical shapes in a wide range of sizes and wall thicknesses. Our engineers will be glad to assist you in developing the product to meet your specific needs.

Write for Bulletin CP554.

THE ORIGINAL FABRICATORS OF TEFLON PACKINGS AND GASKETS

*duPont Trademark

CHEMICAL & POWER PRODUCTS, Inc.

5 Broadway, New York 4, N.Y.

Pumping Progress Report

FOR CHEMICAL ENGINEERS

An advertisement prepared by the Aldrich Pump Co., Member of Hydraulic Institute, U.S.A.

SPACE, in many pump installations, is a major problem. Another is the necessity for special foundations. When new installations are considered, these factors may dictate more elaborate construction than should be necessary. And for replacement or modifications of existing systems, they may require expensive piping and equipment changes.

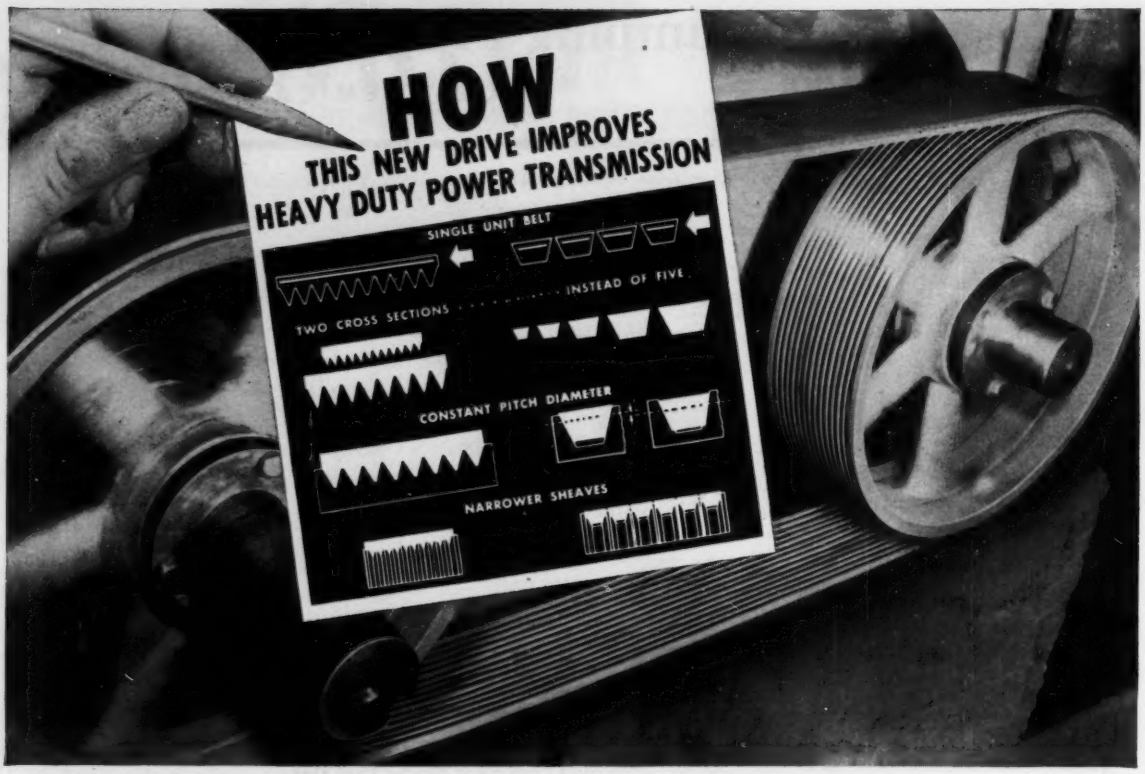
COMPACTNESS OF DESIGN, while often desirable, is not necessarily the answer. Simplicity of design — as in the case of ALDRICH Direct Flow Pumps — may be a better solution.

SIMPLICITY OF DESIGN brought about the first inverted Triplex and Quintuplex Pumps and ultimately Septuplex and Nonuplex Pumps. This Aldrich design innovation brought to pump users many economies of space, maintenance and operation they had never known.

INVERTED PUMP DESIGN permits the use of less expensive foundations. With the crankshaft located near the floor there is no need for expensive foundation work to raise the driver or lower the pump. Then, too, inverted pumps require fewer square feet of floor space than conventional pumps.

MAINTENANCE COSTS ARE REDUCED. Fluid-end, where most work is done, is at chest level. Bearing replacements are made without removing heavy crankshafts or connecting rods. Crossheads on all Direct Flow Pumps can be worked on or removed from pump without disturbing fluid-end.

TELL US ABOUT YOUR PUMPING PROBLEM. The chances are that one of our standard pumps — or a modification of one — will do your job. Detail your problem and we'll send you a copy of the Data Sheet that describes the Direct Flow Pump we recommend. Write to: The Aldrich Pump Company, 3 Gordon St., Allentown, Pa.



R/M *Poly-V®* Drive

Delivers More Power in Less Space!

No other belt drive can deliver as much power in the same space. It's R/M's patented Poly-V Drive developed by R/M engineers after years of research. This totally new concept in power transmission delivers up to 50% more power than a conventional V-belt drive of equal width.

Unique design accounts for the unusual power capacity of R/M Poly-V Drive. A *single, endless* belt with parallel V-ribs runs on sheaves specially designed to mate precisely with the belt ribs. The uniform pull of this single unit belt distributes drive load evenly over the full width of the sheave . . . gives higher horsepower capacity per inch of drive width than ever before possible.

There are many advantages in this space-saving drive wherever heavy duty power transmission is required . . . in the equipment you manufacture—or the equipment you use in your plant. Poly-V Drive has eliminated the matching problems of multiple V-belt drives, greatly increased the life expectancy of belts and sheaves and maintains more constant speed ratios under all loads. Just *two* cross sections of Poly-V meet every heavy duty power requirement—R/M Poly-V Drive cuts costly belt and sheave inventories to a new low!

Let the R/M engineers who developed Poly-V Drive work with your engineers to improve your power transmission applications. Contact R/M . . . or write for a copy of Poly-V* Drive Bulletin #6638.

CONDOR V-BELTS • R/M SUPER-POWER V-BELTS

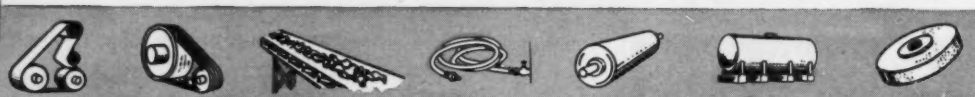
Write for Bulletin #6868 on the complete line of Condor V-Belts for regular service on conventional V-belt drives. Also write for Bulletin #6628 on R/M Super-Power V-Belts with 40% more Horsepower capacity where needed.

*Poly-V is a registered Raybestos-Manhattan trademark

RM 648

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



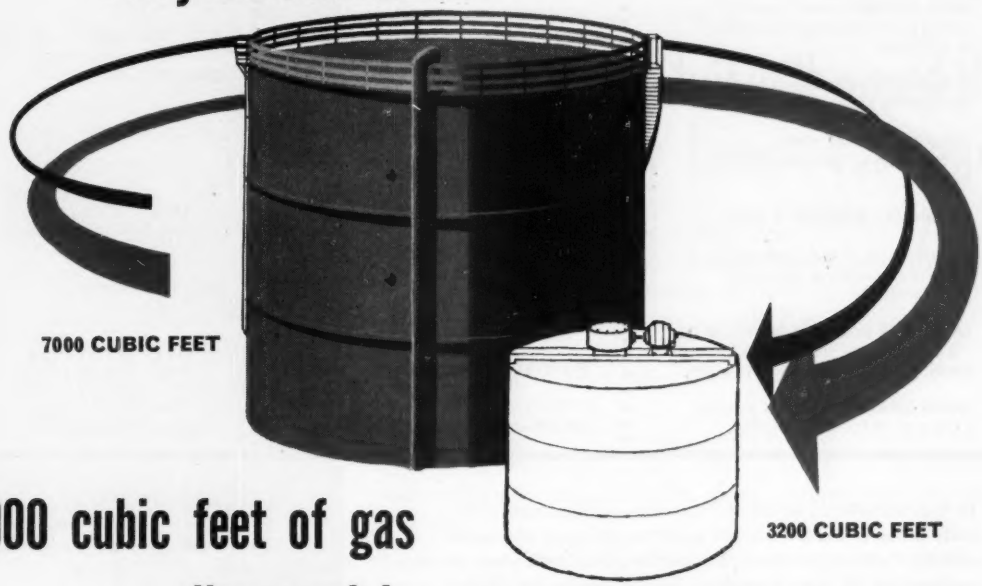
Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

Turbo-Topics

TURBO-MIXER GENERAL AMERICAN TRADE MARK

TURBO-MIXER, a division of
GENERAL AMERICAN TRANSPORTATION CORPORATION

every 60 seconds...



7000 cubic feet of gas dispersed in 3200 cubic feet of liquid —with TURBO on the job

If absorption of gas into liquid is your problem, put Turbo to work. Turbo Gas Absorbers handle up to 7000 cfm with proved operation. They are available in sizes up to 84″—the largest mechanical gas absorbers in operation. What's more, only Turbos can be designed to self-induce gas into the liquid.

Turbos can solve your agitation problems, whether your business is petroleum processing, chemicals, pharmaceuticals or minerals beneficiation. Turbo's built-in ruggedness that provides continuous 24-hour heavy-duty service assures you of "headache-free" production and lower costs in the long run.

SALES OFFICE: 380 MADISON AVENUE, NEW YORK 17, NEW YORK
General Offices: 135 S. La Salle St., Chicago 90, Illinois • Offices in all principal cities

OTHER GENERAL AMERICAN EQUIPMENT:—DRYERS • DEWATERERS
TOWERS • TANKS • PRESSURE VESSELS

9,121 ways to valve corrosive substances with HILLS-McCANNA valves

36 BONNET ASSEMBLIES

HANDWHEEL OPERATED—13 types including models with indicators, auxiliary handles, enameled bonnet and outside stem and yoke.

QUICK OPENING—2 lever operated models go from full open to full closed in a 180° turn.

SLIDING STEM—5 models to permit adaptation to a wide variety of operators.

EXTENDED STEM—2 models provide easier operation in difficult locations.

CHAINWHEEL OPERATED—1 model.

AIR OPERATED—9 models offered with a choice of air cylinder or diaphragm motor operators.

UNBALANCED HYDRAULIC OR PNEUMATIC—1 model utilizing pressure on valve diaphragm to close, line pressure to open.

MOTOR OPERATED—3 models providing a choice of electric motor operators.

14 DIAPHRAGMS

RUBBER—3 types including high acid/alkaline resistant, abrasion resistant and temperature resistant.

NEOPRENE—5 types including acid, alkaline, oil and heat resistant formulations, freeze resistant and white, noncontaminating formulations.

HYCAR—acid, oil and heat resistant.

TYGON—acid resistant.

COMPAR—solvent resistant.

KEL-F—acid resistant.

POLYETHYLENE—acid resistant.

TEFLON—maximum chemical resistance.

27 BODIES

CAST IRON—ASTM Class 3 minimum.

CAST STEEL—standard foundry finish.

CAST IRON, LINED—choice of 8 linings including hard or soft rubber, neoprene, glass, lead, Saran and Lithcote.

CAST IRON, COATED—Stalpic coated.

ALLOY—choice of 10 alloys including several types of stainless steel, Durimet, Everdur, Monel and Hastelloy.

ALUMINUM—Cast.

NICKEL—97%+ pure.

PLASTIC—Choice of 4 materials: polyvinyl chloride, Uscolite, Saran or polyethylene.

In this unmatched selection of operators, diaphragms and body materials is the answer to virtually every corrosion resistant valving problem. In addition, nearly 25 years of application of the Saunders Patent valve by Hills-McCanna has developed extensive experience records on the best way to handle thousands of corrosive substances. The combination of a complete choice of materials plus Hills-McCanna "know how" is your assurance of getting the *best* valve for your service.

Hills-McCanna diaphragm valves are offered in sizes from ⅜" through 14". Dependent on size and type of body and diaphragm materials, they will handle pressures to 150 psi, temperatures to 350° F. For specific recommendations send an outline of your corrosion resistant valving problem. To have full data at hand, ask for the Hills-McCanna valve catalog.

HILLS-McCANNA...

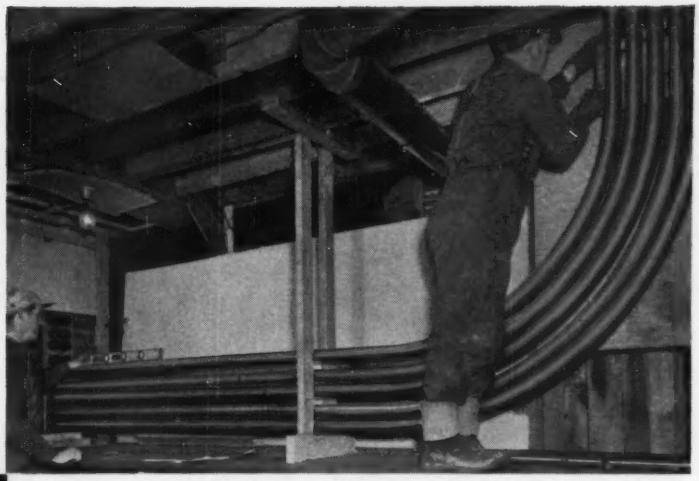
Corrosion Specialists Since 1870

HILLS-McCANNA CO.

2341 W. Nelson St. Chicago 18, Illinois

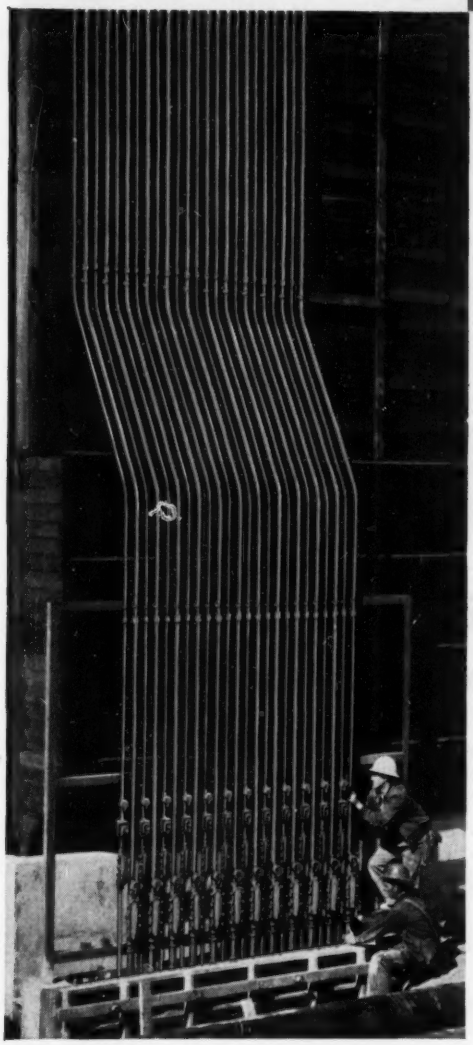
Manufacturers of: Saunders Patent Diaphragm Valves • Chemical Metering and Proportioning Pumps • Force Feed Lubricators • Light Alloy Castings

DOWN a humid 180 feet below water level at Downsville Dam



Some 3600 feet of 2" Everdur Conduit (E.M.T.) protect electric lines in a service shaft plunging down to the release water chamber 180 feet below water level at Downsville Dam of the New York Metropolitan Water Supply System. Electric lines operate vital valves, indicating and communication equipment.

UP in the corrosive air at a water cooling tower



During the War, General Petroleum Corp. saw galvanized conduit fail within a year at one of its plants—replaced it with Everdur Conduit. At its new Ferndale Mobilgas Refinery in Washington, some 12,000 pounds of Everdur Conduit in various sizes guard electric power lines for motors and lighting in this water cooling tower.

EVERDUR Conduit will guard the electric power lines—for years

Everdur* Never Rusts. It offers high resistance to other types of corrosion. That's why Everdur Conduit—made from one of Anaconda's exclusive copper-silicon alloys—is specified for dependable year-after-year protection of electric power lines in industry, on bridges, at power and water supply projects—wherever water and corrosive atmospheres are a problem—or where conduit must be buried or embedded in concrete.

Everdur is Tough. In addition to corrosion resistance, Everdur has high physical strength, resists wear and abrasion. It stands up under movement and vibration, as on a bridge, in a subway, in a factory.

Everdur is Nonmagnetic. Everdur Conduit creates no magnetic field to produce temperature rise in electric power cables.

Everdur Electrical Conduit is available in two wall thicknesses —R.C. in nominal sizes from ¼" to 4", inclusive, and E.M.T. in nominal sizes ⅜" to 2", inclusive. For more detailed information write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 55130

*Reg. U. S. Pat. Off.

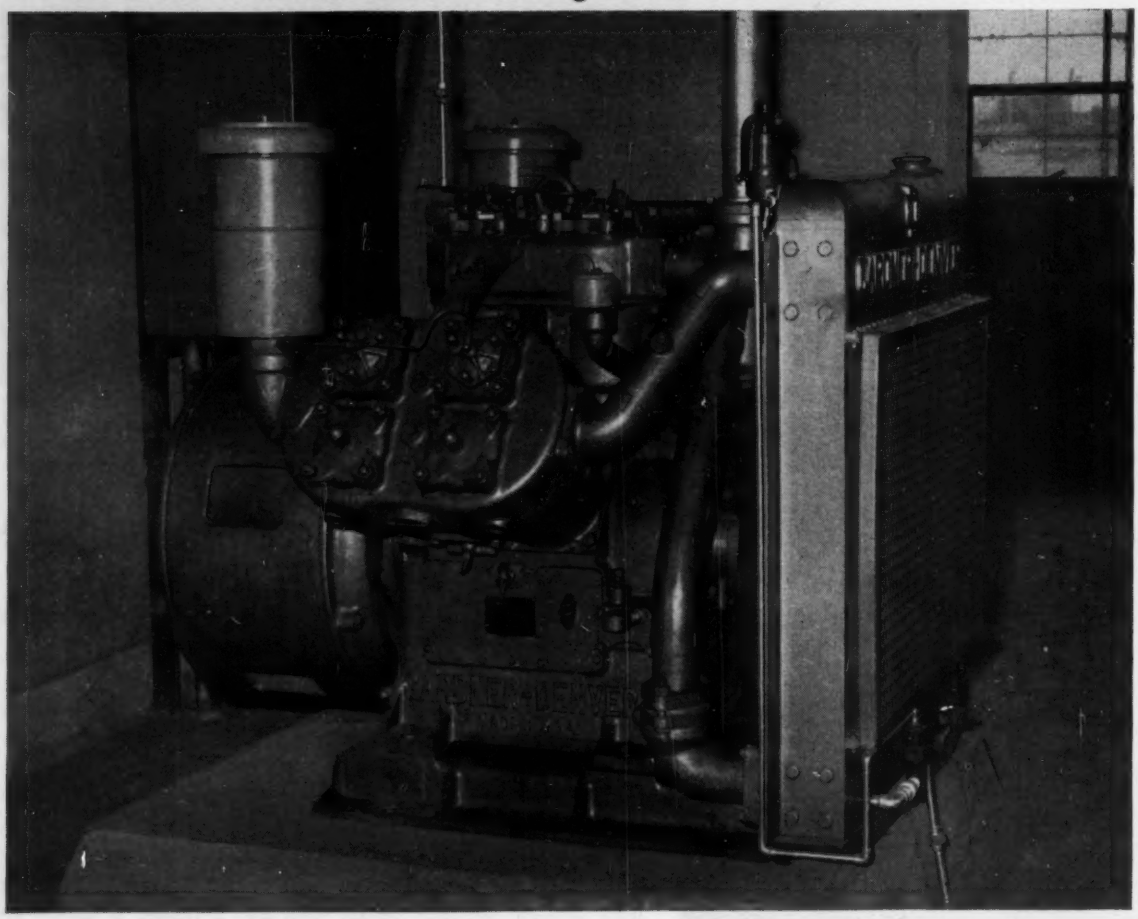
EVERDUR ELECTRICAL CONDUIT

ANACONDA®

COPPER SILICON ALLOYS

CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE

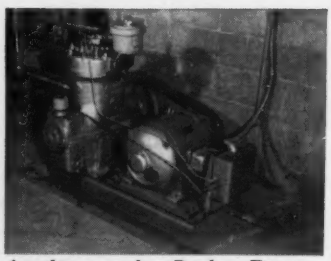
Gardner Denver . . . Serving the World's Basic Industries



Moves in fast . . . starts right away . . .
Gardner-Denver WB Compressor

It's as easy as it looks in this picture to install a Gardner-Denver WB Compressor. Hook up the wiring . . . air line . . . controls—that's about all there is to it. Not much of a foundation is needed—because vibration has been designed out of the machine. The packaged unit has a built-in motor, and a self-contained radiator-intercooler that solves cooling-water problems.

Available in seven sizes from 142 to 686 cfm. Write for Bulletin WB-10, with full specifications.



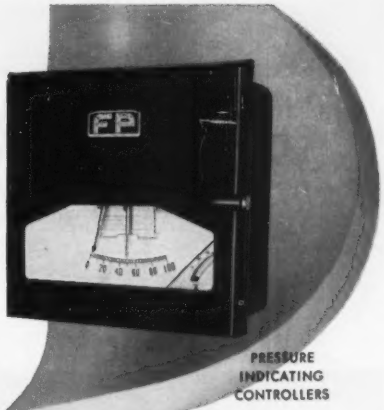
Another popular Gardner-Denver compressor—noted for long, steady runs—the model AA. Bulletin AA6.

GARDNER - DENVER

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

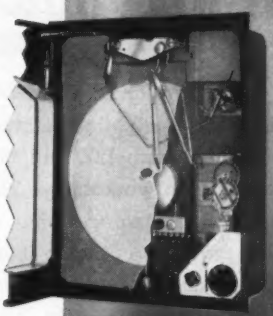
Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

get PRESSURE INSTRUMENTS FAST from F&P

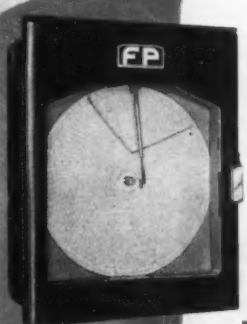


PRESSURE INDICATING CONTROLLERS

INDICATING PRESSURE TRANSMITTERS



PRESSURE RECORDING CONTROLLERS



PRESSURE RECORDERS

Fischer & Porter now proudly offers a complete line of pressure instruments for one week shipment from stock. These accurate pressure instruments may be used to measure vacuum pressure or gauge pressure from absolute zero to 1,000 psig.

The pressure elements are available in brass, 316 stainless steel, phosphor bronze and beryllium copper. Guaranteed accuracy of all instruments is 1% of full scale, with positive over-range and under-range protection built into each instrument. Recorders, recording controllers, indicators, indicating controllers and pneumatic transmitters are available for one week shipment.

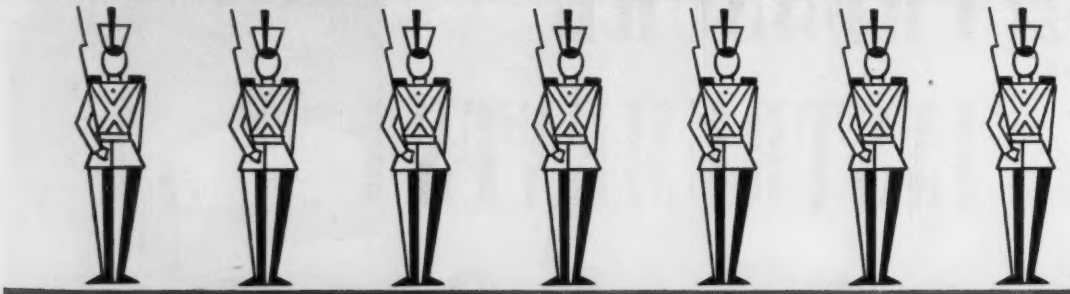
But why wait until an emergency demands fast delivery? Why not get to know the entire F&P instrument line better, now? A word from you will bring completely detailed information without obligation.

Fischer & Porter is in the instrument business to assist you. Doing it expertly and well has helped F&P grow. Get to know F&P better, call on F&P for a single instrument or a complete process instrumentation system.

FP FISCHER & PORTER CO.

126 COUNTY LINE ROAD, HATBORO, PENNA.

LA1054

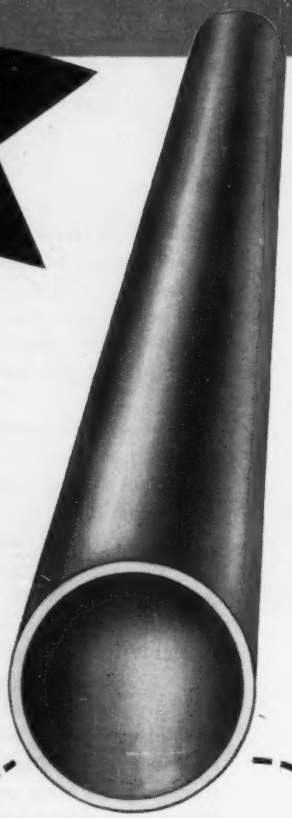


UNIFORMITY

. . . Another Big Advantage of WELDCO *Welded* TUBING

When you order WELDCO Tubing, you're sure to get **complete uniformity** throughout—uniform wall thickness, uniform weight, uniform I.D. and O.D., uniform close grain structure, and uniform workability. These are some of the important advantages of welded tubing, and they guarantee you a **dependable** product . . . tubing that has excellent fabricating qualities . . . tubing that's easy to bend, form, weld and assemble.

Remember, too—only WELDCO Tubing is welded with the exclusive Double-Fusion Process. It's available in Stainless Steel, Monel, Hastelloy, Inconel, Nickel, and Cupro-Nickel, in tube and pipe sizes from 3" to 30", Schedules 5 and 10, and 3" to 12", Schedule 40. For special problems, or regular applications, always specify WELDCO—your best buy in top-quality, **uniform** tubing!



Whatever Your Needs In Tubing . . . You're 'Way Ahead With WELDCO

WELDCO

THE YOUNGSTOWN WELDING & ENGINEERING COMPANY
3763 OAKWOOD AVENUE . . YOUNGSTOWN 9, OHIO

ADVANTAGES FOR ALKYDS . . . WITH

Glycerine

NEW WEATHER RESISTANCE

A new type of weather-resistant alkyd resin—made from isophthalic acid and *Glycerine*—is now being offered in experimental quantities.

The stability and compatibility of Glycerine as a polyol in surface-coating alkyds and its low MW/Hydroxyl ratio, have for years made a wide range of resin properties feasible.

Now Glycerine is combined with isophthalic, a dibasic acid which only recently became available in commercial quantities and which imparts higher viscosity with lower acid number. It also permits higher fatty acid content at workable consistencies. The result: excellent outdoor durability, mildew-resistance and gloss-retention—all demonstrated in a five-year exposure test completed recently. Among 100 alkyd-based enamels tested, an isophthalic-soybean-Glycerine alkyd enamel stood up best.

Here again, *nothing takes the place of Glycerine.*

This balanced group of properties keeps Glycerine's usefulness growing

HYGROSCOPICITY • STABILITY • SOLVENT POWER • VISCOSITY • NONVOLATILITY • NONTOXICITY • TASTE • MW/HYDROXYL RATIO •

HUMECTANT • CARRIER • SOLVENT • LUBRICANT • SOFTENER • EMOLLIENT • ANTI-FREEZE • ALKYD BASE •

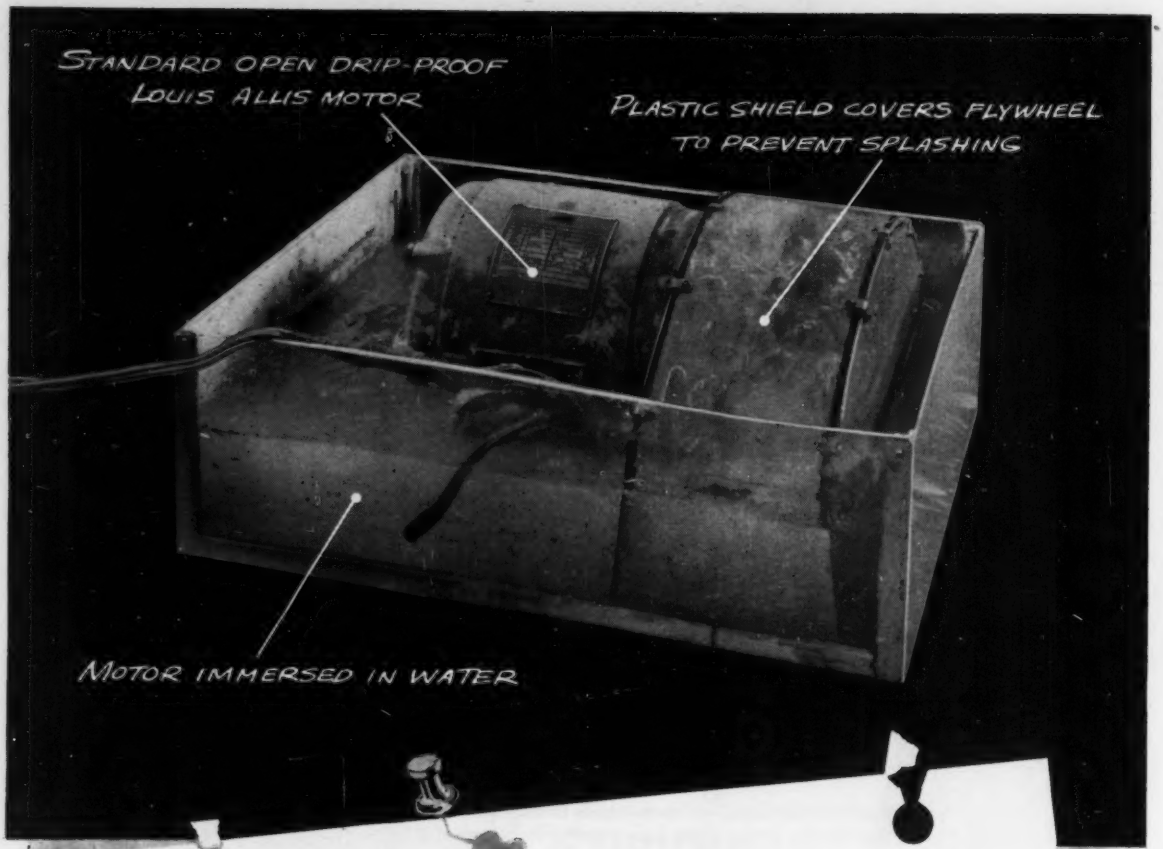
☑ CHECK AND SEND FOR TECHNICAL DATA

☐ 20-page booklet "Glycerine Alkyds Tailored to Need"

☐ 8-page booklet on "Federal Specifications for Glycerine"

☐ 16-page booklet on Glycerine properties and applications

For your free copy of any or all of these booklets write: **GLYCERINE PRODUCERS' ASSOCIATION** • 295 Madison Ave., New York 17, N.Y.



In water 1½ years...still running

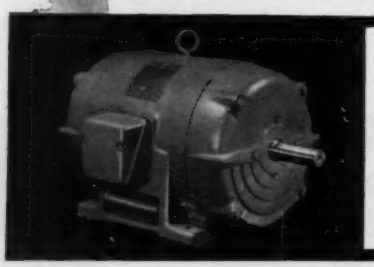
Dramatic proof that Louis Allis motor insulation provides unusual moisture resistance

We wouldn't do this to a motor. But somebody did, to check our new insulation. They took a standard open drip-proof motor, placed it in water up to the shaft, and ran it a year and a half.

The motor will still run, too, which proves that our insulating materials are of top quality. One of our exclusive features is the new phenolic impregnating varnish we use. As you can see, this varnish resists moisture, but it also has excellent thermal and chemical resistance and is not susceptible to embrittlement.

Insulation usually determines the life of a motor. That's why the insulating materials used in the new L. A. line are the product of years of continuous research and development. That's why Louis Allis motors run longer . . . give less trouble.

Find out the many other advantages available to you in the new L. A. line of motors. Write for our new bulletin No. 1700.

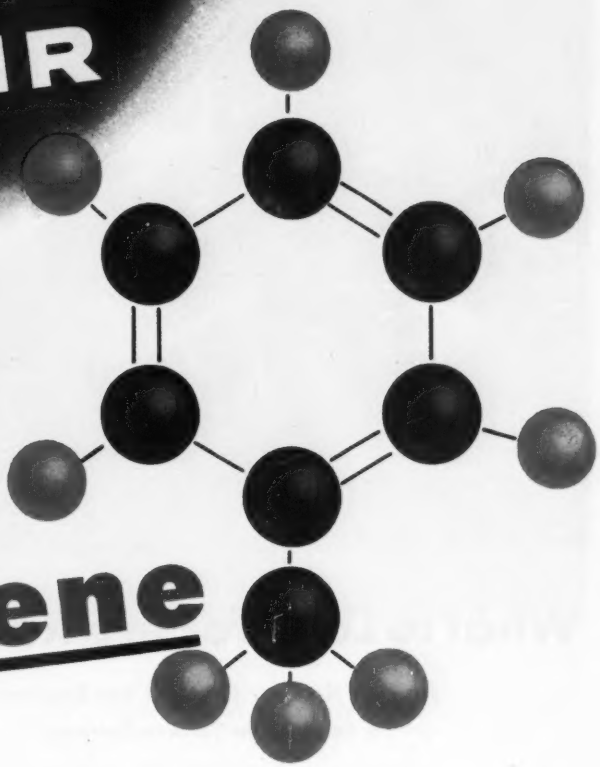


A complete line of standard rerated motors in frames 182 through 326U now in stock. Special rerated motors are available on short delivery.

LA-107

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

now from SINCLAIR



Toluol
Xylol
Paraxylene

and Heavy Aromatic Solvents

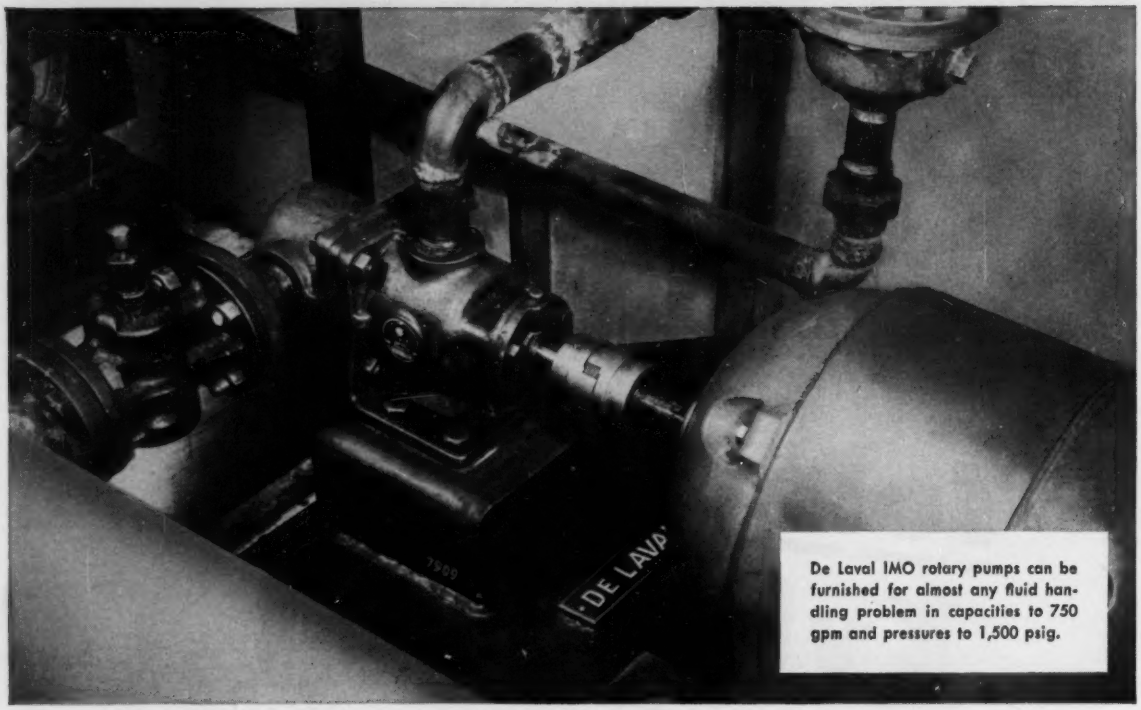
Do your manufacturing processes call for high-purity aromatic hydrocarbons, including toluol, xylol, paraxylene, and heavy aromatic solvents? If so, Sinclair has the answer to your needs.

Sinclair's newest chemical unit, recently completed at Marcus Hook, Pa., has been especially designed to provide dependable supplies of aromatic chemicals for industry. The operation of this modern Sinclair unit marks another step forward in Sinclair's progress in the petro-chemical field.

Why not investigate this new source of supply *today?* Write or call–

SINCLAIR CHEMICALS, INC.

(Subsidiary of Sinclair Oil Corporation) 600 Fifth Avenue, New York 20, N. Y., Circle-6-3600



De Laval IMO rotary pumps can be furnished for almost any fluid handling problem in capacities to 750 gpm and pressures to 1,500 psig.

What to Look for in a Rotary Screw Type Pump

By W. J. MONCON, *Assistant Chief Engineer*
De Laval Steam Turbine Company

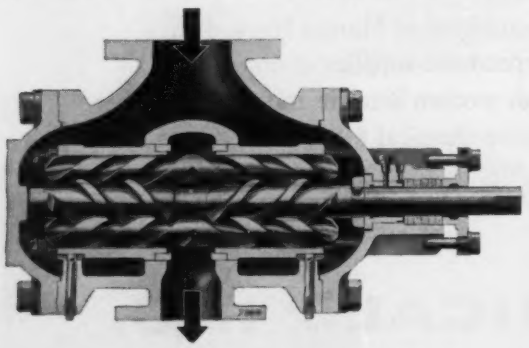
A sound knowledge of design, and how it affects performance, is the best insurance a buyer can have that he will get the pump he needs. This brief analysis of the IMO, a rotary three-screw pump manufactured by the De Laval Steam Turbine Company, will give you some of the necessary facts.

What qualities should you look for in a rotary type pump? It must, of course, meet specified capacities and pressures. But, it must also be efficient, operate quietly, stay on the job.

The axial flow of a screw type pump, and the resulting low inlet losses for any given pump speed, are important benefits that should be considered in making pump selections. The absence of timing gears and other mechanical features of construction also enable the De Laval IMO pump to operate at direct-connected motor and turbine speeds . . . to handle viscous liquids and high suction lifts.

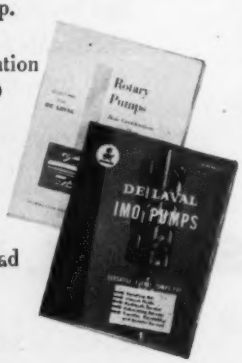
One of the most important features of the IMO pump is the hydraulic turning of the idler or sealing rotors. The central or power rotor is the pumping element; the liquid pumped turns the sealing rotors.

A screw type pump is well suited for applications where pulsation-free flow is desirable. The axial flow of the liquid without trapping and the unique thread form which keeps closures fluid-tight contribute to quiet operation of the IMO pump.



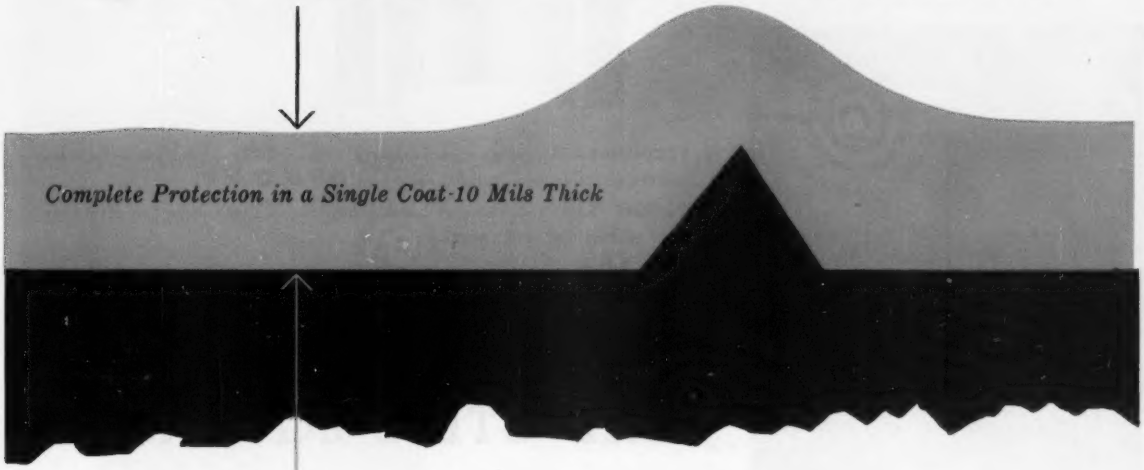
De Laval IMO Series A322A, a positive displacement, rotary screw type pump, can handle capacities to 750 gpm and pressures to 150 psig.

Catalog LS gives useful application and specification data on the IMO pump. An article titled, *Rotary Pumps, Basic Considerations in Their Application,* contains a description of rotary pumps in general. For these publications, write on your company letterhead to De Laval Steam Turbine Company, 803 Nottingham Way, Trenton 2, New Jersey. DL-301



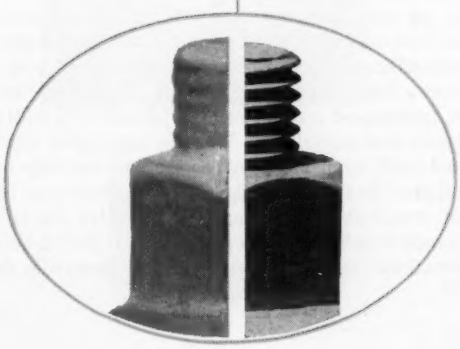
you can

CUT YOUR MAINTENANCE PAINTING COSTS UP TO 50% *with* AMERCOAT 87 VINYL MASTIC



HERE IS HOW THIS REMARKABLE PROTECTIVE COATING CAN SAVE YOU MONEY:

1. Only one cross spray coat over a primed surface is required for complete protection—this means lower labor costs.
2. Fewer scaffolding and rigging shifts are required.
3. Less down time—dries to touch in minutes, eliminates the risk of contamination between coats.
4. Greater thickness means longer life—lower cost per square foot per year.



Amercoat 87's thixotropic characteristic helps provide extra thickness on sharp edges and irregular surfaces; it is non-porous and will not crack or check.

Amercoat 87 combines the time-tested chemical and weather resistance of vinyl coatings with the thickness of conventional mastics, yet is easily applied with standard industrial spray equipment.

We will be pleased to send you our technical bulletin describing this coating in detail.

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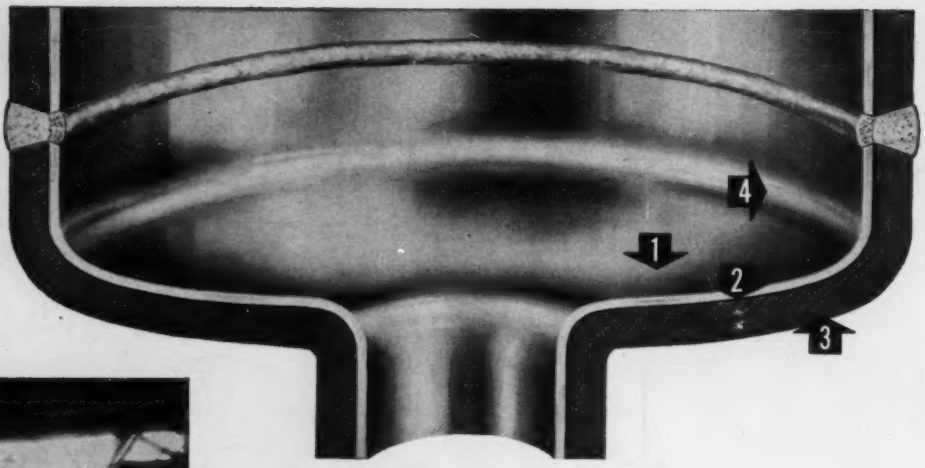
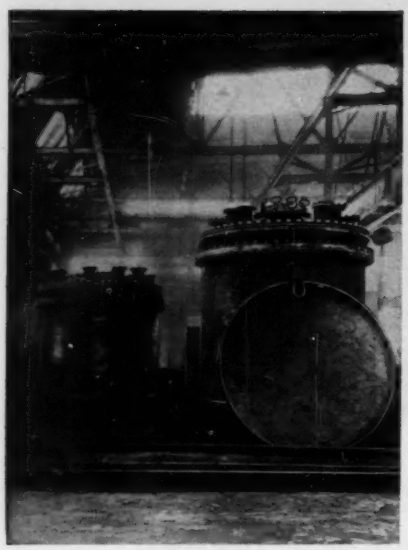
DEPT. AB, 4809 FIRESTONE BOULEVARD, SOUTH GATE, CALIFORNIA Evanston, Ill. • Kenilworth, N.J. • Jacksonville, Fla. • Houston, Tex.





These chemical reaction tanks were fabricated from wide plates of Nickel-Clad Steel.

1. **ECONOMY**—High-alloy layer—usually 10% or 20% of total plate thickness—assures corrosion and abrasion resistance, long equipment life.
2. **DESIGN FREEDOM**—Integral bond allows design and fabrication of shapes to meet process and space needs.
3. **STRUCTURAL STABILITY**—Carbon or alloy steel backing gives required strength and rigidity at lower cost.
4. **LESS MAINTENANCE**—Smooth, hard surfaces, rounded corners and sloping bottoms mean easy cleaning and draining.

CLAD STEEL EQUIPMENT IS EASIER TO CLEAN AND MAINTAIN

Where cleaning and maintenance problems hamper continuous operation, slow down process change-overs or run production costs up, corrosion-resistant clad steel equipment can provide the *economical* solution. Clad's smooth, high-alloy surfaces are virtually maintenance-free, often need only to be flushed with water. Where drastic cleaning methods must be used, the clad surfaces won't chip or peel. Because of the permanent bond between cladding and backing, tanks and vessels may be designed with the rounded corners and sloping bottoms that assure quick, easy drainage.

There are sixteen Lukens' Clad Steels—various types of stainless, nickel, Inconel, Monel, copper. They give you corrosion and abrasion resistance, protect product purity to the same degree as solid high alloys with savings of up to 50% in material costs. The ASME Code permits full gage consideration for design purposes because cladding and backing are bonded over their entire surface.

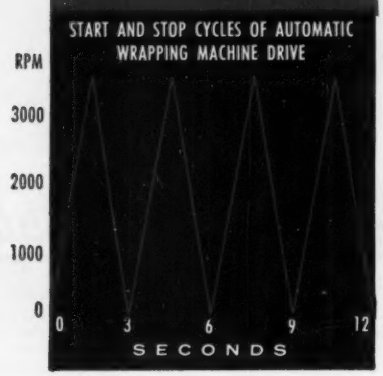
To get these benefits, plus long life under pressure, vacuum or thermal cyclical service, fast heat transfer and easy modification when processes change, ask *qualified* builders about clad steel equipment. These men are experts, understand your problems, and will work with your engineers and consultants. We offer the widest selection of clad steels available anywhere and we can help in the selection of the type of clad steel that best suits your needs. If you would like more information, consult one of your equipment builders, or write Manager, Marketing Service, Lukens Steel Co., 749 Lukens Building, Coatesville, Pa.

LUKENS CLAD STEELS

STAINLESS-CLAD · NICKEL-CLAD · INCONEL-CLAD · MONEL-CLAD

PRODUCER OF THE WIDEST RANGE OF TYPES AND SIZES OF CLAD STEEL PLATES AND HEADS AVAILABLE

20 ROLLS OF "SARAN WRAP" EVERY MINUTE



The Dow Chemical Company's production of "Saran Wrap" has leaped from 130,000 rolls to 4,000,000 rolls a month since 1951. This up-swing is due to a new plant, a new flow system, and additional equipment including new machinery equipped with Reliance V★S Drives.

One of the most dramatic applications of V★S Drives is on the final wrapping machines shown here. The drives must be able to start, accelerate to 3500 rpm., and stop more than 20 times a minute.

The most important feature, though, is not the frequent starts and stops, but the delicately controlled acceleration of the drives. "Saran Wrap" is only 1/6th as thick as a human hair, and sharp or jerky starts will cause a break in the sheet and halt production. Reliance Drives do the job day in and day out without a single break due to uncontrolled acceleration.

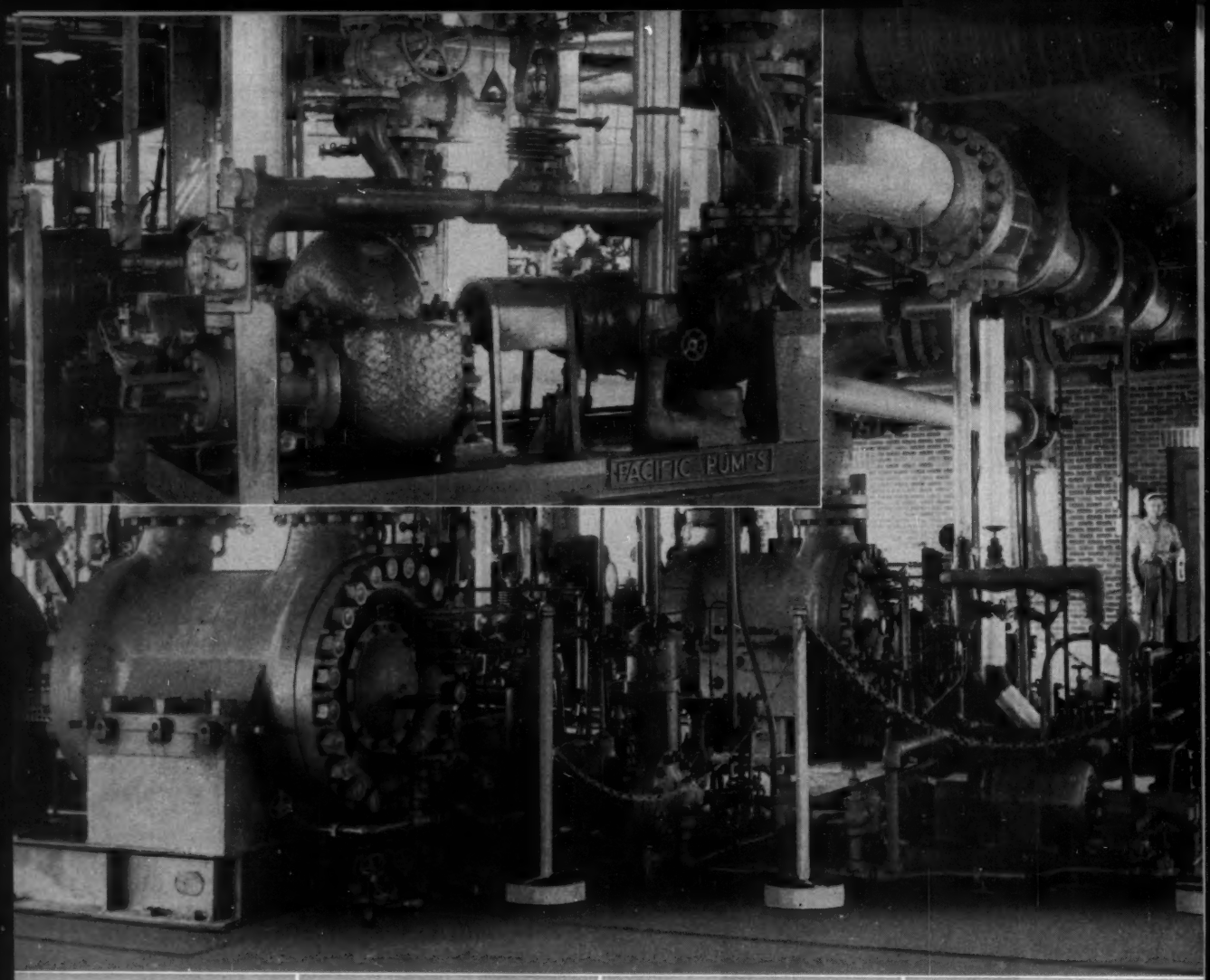
RELIANCE V★S DRIVE ®

Whether you handle a thin film of plastic or steel billets, on a complete production line or a single machine, Reliance can give you better quality, more production, and lower costs through Variable Speed Drives. D-1506

Write for bulletin D-2311.

RELIANCE ELECTRIC AND ENGINEERING CO.

CLEVELAND 10, OHIO • OFFICES IN PRINCIPAL CITIES
Canadian Division: Welland, Ontario



IDECO

IDECO, Dallas, Tex.—Hydrair and Power Rigs; Full-View Masts; Substructures; Single, Dual and Drive-In Rambler Rigs; Blocks, Swivels, Rotaries; Mud Pumps; Petroleum Equipment and Supplies.

Magcobar.

MAGNET COVE BARIUM CORP., Houston, Tex.—Magcobar and Magcogel drilling muds and other specialized oil well drilling fluids and chemicals.

Security

SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif. — Rock bits, reamer rock bits and hole openers; reamers, casing scrapers and Neo-Red rubber stabilizers.

PACIFIC

PACIFIC PUMPS, INC., Huntington Park, Calif. — Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.

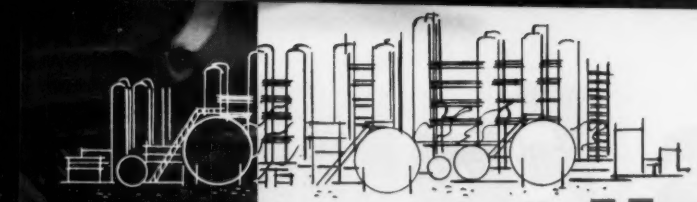
CLARK®

compressors for every application

Clark Bros. Co. is the country's leading manufacturer of heavy duty compressors and turbo machinery for the petroleum, gas, process and general industry.

Clark builds a complete line of centrifugal compressors in the 1,000 – 100,000 CFM capacity range. Pressures in excess of 2,500 psi can be readily handled. Gas turbines in the 8,500 BHP class and Mobile power plants in the 5,500 – 6,500 KW capacity are also built by Clark as are axial flow compressors and recovery turbines.

A complete line of reciprocating compressors in gas, steam, diesel and electric motor driven types are available in the 75 – 4,500 BHP range. Included in the line are the world's first 2-cycle turbo-supercharged gas-engine-driven compressors. Clark builds a compressor to fit practically any heavy duty application.



How the DRESSER *plus* + works...

Throughout the petroleum and petrochemical industries, products of Dresser companies are teamed together to help produce and process the fuels and chemicals so vital to the modern world.

For instance, at Shell Oil Company's Deer Park, Texas refinery, Clark barrel type centrifugal compressors handling hydrogen at high pressure on a reforming application team up with Pacific process pumps. The Clark units, shown in the large illustration, are the first of their type placed in service.

Handling hydrogen at pressures approaching 1,000 psi calls for compressors that are the ultimate in design, material and workmanship. The fact that 75% of all reforming plants of this type use Clark barrel type centrifugal compressors speaks for itself.

At the upper left, the Pacific pumps are shown in operation moving thousands of gallons of process stock daily.

In this Clark-Pacific equipment team operators gain the experience, engineering, research and development facilities and resources of all the Dresser companies.

This in turn results in equipment that is modern in design and unequalled in performance, dependability and long life. You get the Dresser Plus + by specifying Dresser products and equipment . . . the standard of comparison the world over.

ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind.— Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, and positive displacement meters.

LANE-WELLS CO., Los Angeles, Calif., Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot perforating and bullet perforating, packers and bridging plugs.

DRESSER-IDECO DIVISION, Columbus, Ohio — Radio and television broadcasting towers, steel buildings, aircraft hangars, mechanical parking garages, electric power substations.

DRESSER MANUFACTURING DIVISION, Bradford, Pa. — Pipe line couplings, pipe repair sleeves and clamps, weldments, forgings, welding fittings, flanges, rings.

DRESSER INDUSTRIES, INC.

OIL, GAS, CHEMICAL AND ELECTRONIC EQUIPMENT AND SERVICES

REPUBLIC NATIONAL BANK BUILDING • POST OFFICE BOX 718 • DALLAS 21, TEXAS

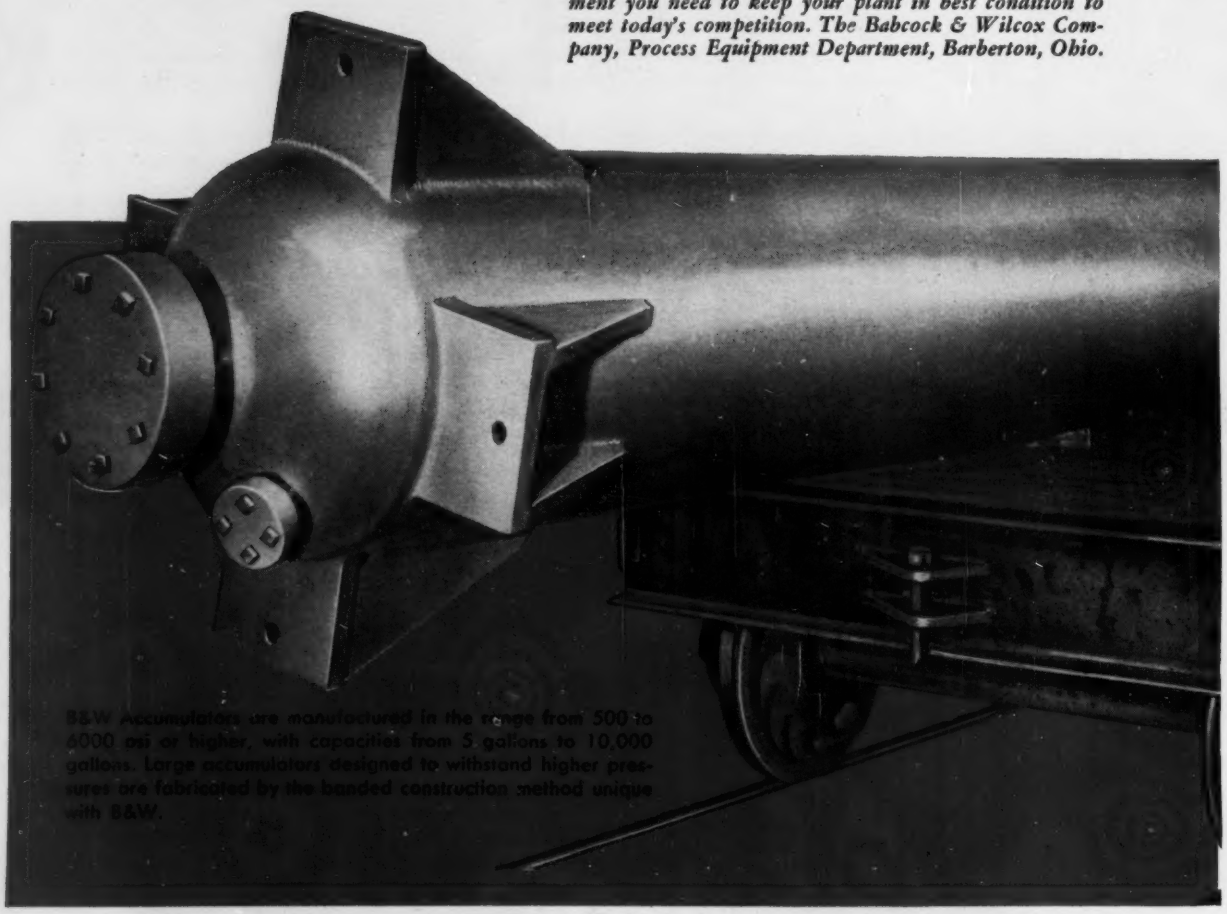
Process Equip
that meets TODAY'S

B&W Accumulators and other Pressure Vessels
• Alloy Castings • Hollow Forgings

The constant progress being made within the process industries demands the utmost of the engineers responsible for the dependability, efficiency and economy of the equipment that serves today's process industries' requirements.

At B&W, forming, machining, welding, X-raying and stress relieving are all performed on equipment specially designed for the job, much of it developed by B&W. And for temperature and pressure problems that arise, new and practical solutions are continually being developed through designing skill based on long experience.

Write for detailed information about the B&W equipment you need to keep your plant in best condition to meet today's competition. The Babcock & Wilcox Company, Process Equipment Department, Barberton, Ohio.



B&W Accumulators are manufactured in the range from 500 to 4000 psi or higher, with capacities from 5 gallons to 10,000 gallons. Large accumulators designed to withstand higher pressures are fabricated by the banded construction method unique with B&W.

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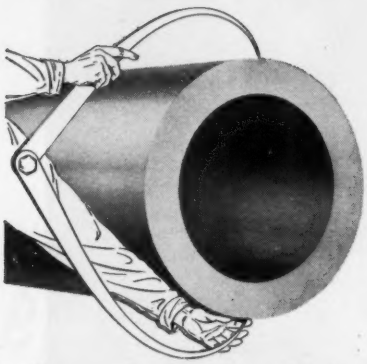
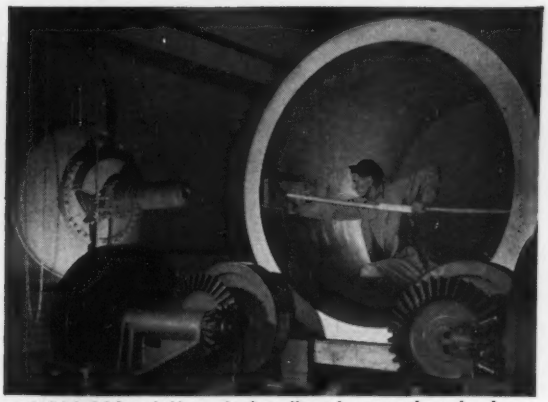
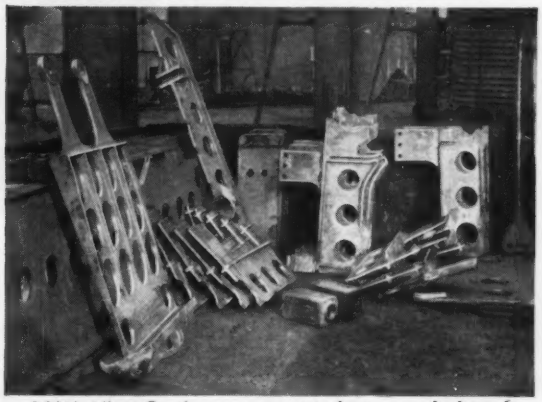
requirements



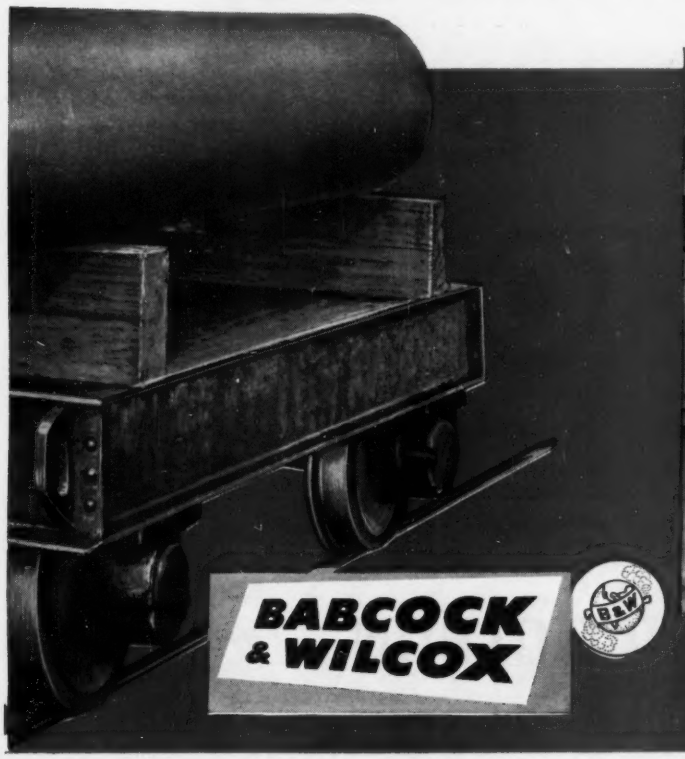
B&W Hollow Forgings are large-diameter, heavy-wall pipes or tubes that offer the designer the advantages of single lengths or many lengths, "tailor-made" to his requirements . . . prompt delivery even on small orders . . . full forging properties resulting from thorough working of the metal . . . excellent concentricity . . . a wide size range. They are supplied in a wide range of carbon and alloy steels, produced in accordance with ASTM Specifications A106, A266, and A335.

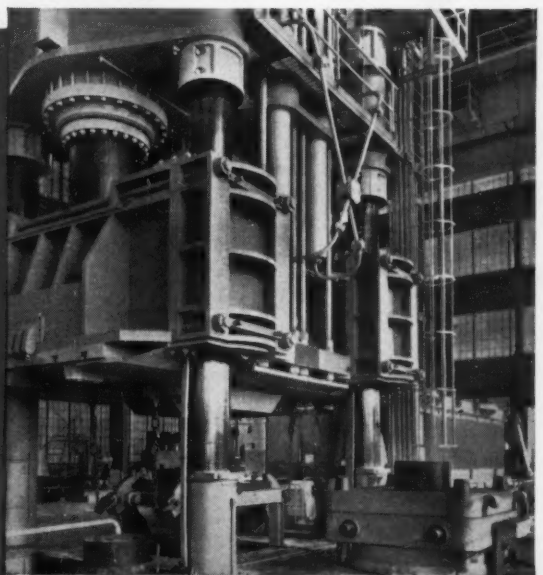


2,000,000-volt X-ray is the all-seeing eye that checks the soundness of welds.



B&W Alloy Castings are cast-to-last . . . designed for long life under the most rigid service conditions requiring superior resistance to abrasion, high pressures and high temperatures.





B&W's giant new press, used in making hollow forgings and other products needed to meet industry's growing demands.

BABCOCK & WILCOX

Nicholson *steam trap* simplicity *gives you*

peak performance, low-cost maintenance

Write, today, for your copy of new Bulletin 10-55—for detailed information.

Nicholson simplicity of design and operation pays off big in any plant . . . in peak performance for chemical processing . . . in easy, low-cost maintenance. Nicholson traps offer the most effective method for discharging condensate and air from steam lines.

- **one moving part—big husky bellows.**
- **positive shut-off—no waste of steam.**
- **high capacity—effective use of large orifice.**
- **each unit service tested—with steam.**

When less than the best won't do, specify Nicholson.

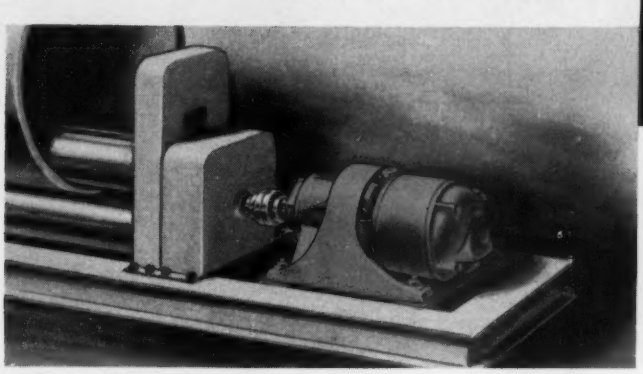
NICHOLSON

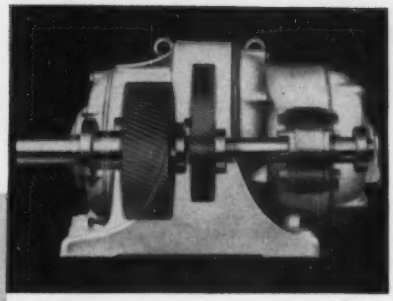
W. H. NICHOLSON *and Company*

TRAPS • VALVES • FLOATS • METAL PARTITIONS
LAUNDRY, DRY CLEANING AND PRESSING MACHINERY

14 OREGON STREET, WILKES-BARRE, PA. • SALES AND ENGINEERING OFFICES IN 98 PRINCIPAL CITIES

Simplify WITH SYNCROGEAR INTERNALLY GEARED POWER

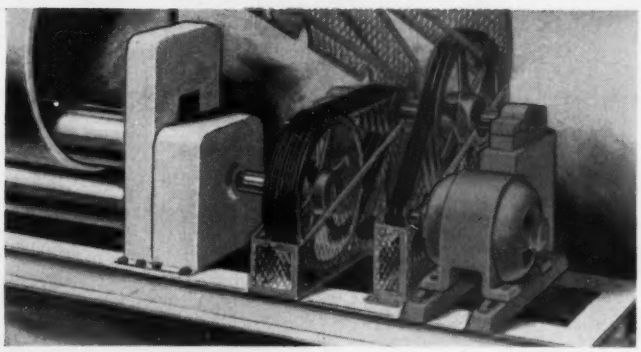


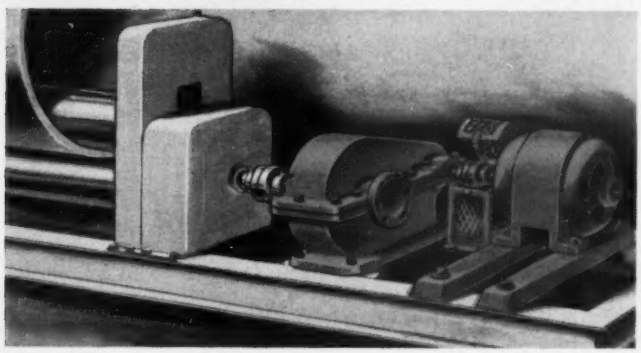


U.S. SYNCROGEAR MOTOR

5 TO 10,000 RPM
½ TO 30 H.P.

Reject CUMBERSOME HOOKUPS





The U. S. Syncrogear is more than a motor. Its "packaged" assembly includes a high speed motor, an enclosed sealed gear-train, correctly engineered for the load, always in exact alignment, all mounted in a single case which saves space and eliminates the ungainly appearance of complicated hookups.

You don't have to calculate chain, sprocket, bearing or shaft requirements, or invest in separate mechanisms, special fabricated guards, extra pulleys and belting when you direct-connect a Syncrogear.

More and more manufacturers are using Syncrogears on their products to improve appearance and increase saleability.

Free – Mail coupon for all new descriptive multicolor booklet with all the facts you should know about geared motors.

U.S. Electrical MOTORS

U. S. ELECTRICAL MOTORS Inc. CHE 2
P. O. Box 2058, Los Angeles 54, Calif., or Milford, Conn.
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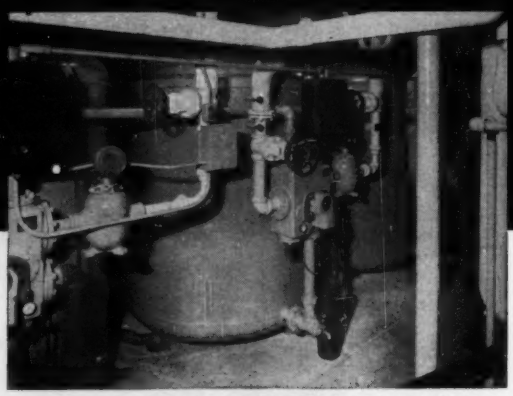
problems in water conditioning...

SIMPLIFIED CONTROL



COCHRANE ZEOLITE SOFTENER DELIVERS WATER of zero hardness by the soap test. All commonly known zeolites—greensand, synthetic gel, sulfonated coal and the various styrene medium capacity resins are available for most practical individual application. Units can be adapted for automatic operation. Three 6' x 6' fully automatic Cochrane Zeolite Softeners above provide a capacity of 288,000 lbs. per hr.

Cochrane

Hydromatic Valve *assures* easy, accurate control of ion exchange equipment

Here is a valve so simple to operate that no knowledge of softening equipment or of the ion-exchange process is required!

The Cochrane Hydromatic Valve consists of an integrated nest of hydraulically-actuated diaphragm valves. Valves are so constructed that it is impossible for any of them to be out of position during operation. Compass point positions for four operating stations on the pilot reduce operating error—assure maximum delivery of high quality effluent without danger of contamination. "Drop tight" construction eliminates the possibility of scoring. Compact, easy to operate Hydromatic Valve is designed for years of dependable operation. Write for Bulletin 4520-B.

The Cochrane Corporation designs and manufactures complete lines of deaeration, precipitation, ion exchange, and water conditioning equipment . . . Consult Cochrane First!

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Representatives in 30 principal cities in U.S.; Toronto, Canada; Paris, France; La Spezia, Italy; Mexico City, Mexico; Havana, Cuba; Caracas, Venezuela; San Juan, Puerto Rico; Honolulu, Hawaii.
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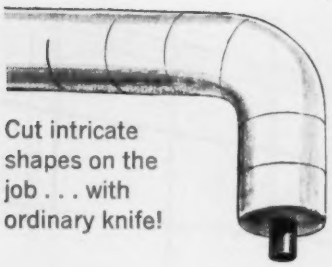
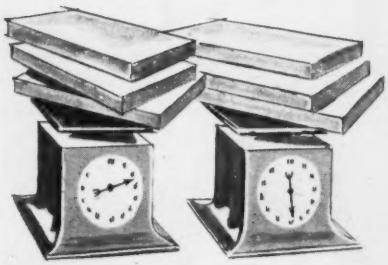


Cut intricate shapes on the job . . . with ordinary knife!



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Can be removed for easy line inspection . . . replaced without damage, waste!

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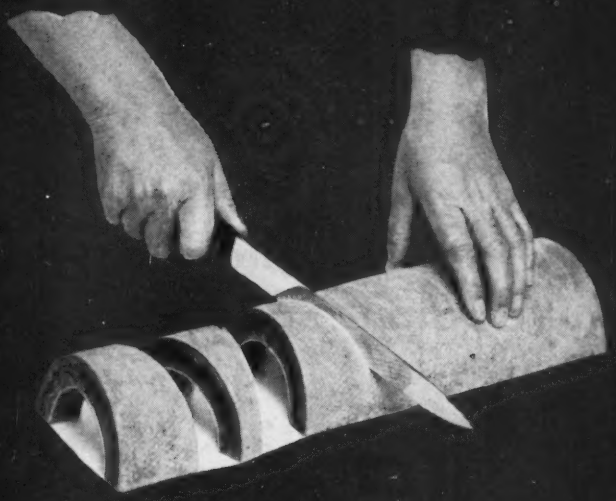

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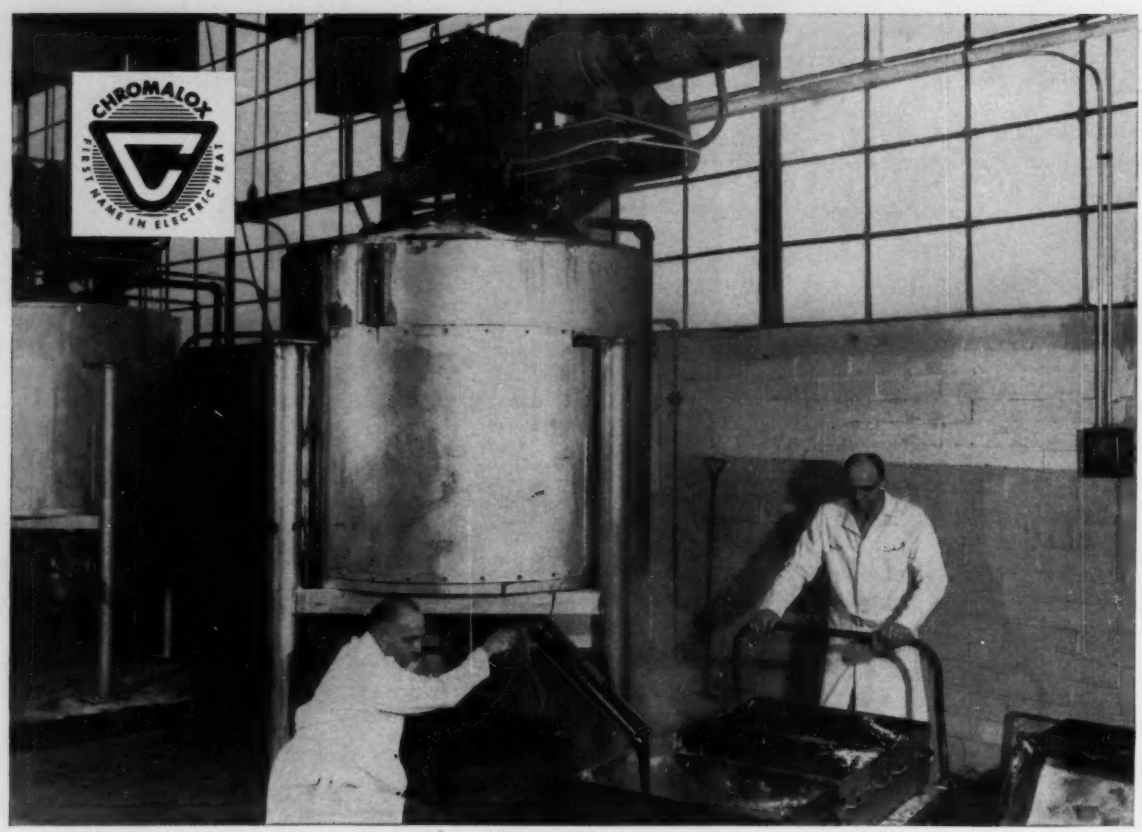


versatile electric heat . . . "cooks" special purpose lubricants

Creating laboratory-like conditions for batch processing special purpose lubricants was accomplished by a large manufacturer of lubricants with the help of Chromalox electric heating units.

Precise, controllable heat to produce the viscosity and chemical reactions necessary for the formulation of many different valve lubricants was obtained by installing Chromalox electric strip heaters on the processing kettles. Grouped into three zones, they supply selective, modulated heat at heat-up and operating temperatures. Since many of the critical chemical reactions take place at temperatures near the flash point of the raw materials, flameless electric heat provided an extra measure of safety.

The electrically heated kettles are used for processing a wider variety of lubricants since the temperature range is greater and input is varied to meet the conditions for batches formulated for widely differing service conditions.

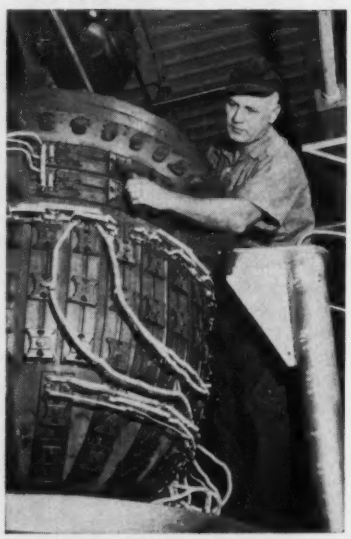
In addition to meeting these exacting operating requirements, Chromalox electric heaters have recorded a real dollars-and-cents advantage in upkeep costs. With no moving parts, totally enclosed, metal-sheathed Chromalox strip heaters have built up three years of maintenance-free service.

Substantial operating benefits like these, in addition to low cost process heat, have made Chromalox electric heating units an important part of the major production processes in industry today.

Always available to you are our research, engineering, design and modern manufacturing facilities. Choose from 15,000 standard sizes, styles and ratings in the world's largest factory stock of industrial electric heaters. Our nationwide sales-engineering service will go all out to help you find the right answer—electrically.

•

FREE—application information on strip heaters. Write for Bulletin F-1566 to see how Chromalox Strip Heaters can help solve your process heat problems.

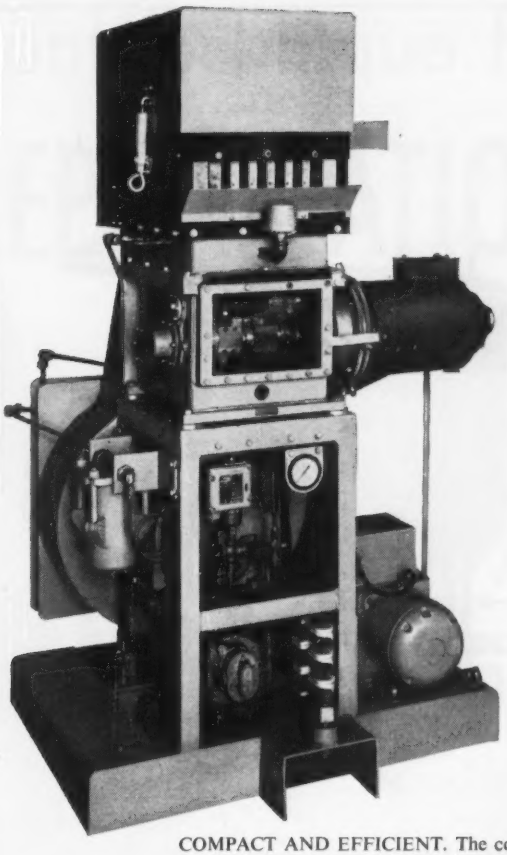


Strip heaters were applied to kettle by means of stud bolts welded in place.

EDWIN L. WIEGAND COMPANY
7514 Thomas Blvd., Pittsburgh 8, Pa.
A-4497A

CHEMICAL COMPANIES

- cut power costs
- save space
- increase production



COMPACT AND EFFICIENT. The contact unit is the heart of the I-T-E Mechanical Rectifier. The contacts are pure solid silver, the best conductor known, and driven by a synchronous motor by means of small, light mechanical parts.

with I-T-E MECHANICAL RECTIFIERS

For every unit of product obtained by electrolytic action, the I-T-E Mechanical Rectifier can reduce the amount of electric energy you have to buy.

The I-T-E Mechanical Rectifier normally operates at an overall efficiency of 96% to 97% or even higher. This efficiency can be translated into power savings totaling thousands of dollars annually. Or it can mean higher production for the same power cost.

Besides reducing power consumption, the I-T-E Mechanical Rectifier offers the advantages of small space-requirements and less costly installation. This means greater overall economy. The first user of I-T-E Mechanical Rectifiers has since ordered eight additional units and has specified still more for electrochemical plants now under construction.

Many improvements have been made since I-T-E first introduced the mechanical rectifier. For example, the unit can be restarted immediately after a shutdown caused by backfire—without changing the contacts. And contact life has been increased.

I-T-E Mechanical Rectifiers are available in single units—6000 through 12,000 amp and 24,000 amp from 50 to 250 volts d-c; 6000 amp and 12,000 amp from 250 to 400 volts d-c.

For additional information, write I-T-E Circuit Breaker Company, Transformer and Rectifier Division, 19th & Hamilton Streets, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Transformer and Rectifier Division

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RAYMOND C. ADAMS
Gilman Paint & Varnish Co.

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"Just a note to advise you of the wonderful results we have obtained with your VISKON discs . . . We have been able to eliminate the use of a Filteraid and have also speeded up the filtering operation and, strange as it may seem, have actually lowered the cost of our filter media . . ."

* * *

(This is a typical statement from many companies which have changed over to VISKON Filter Fabric to speed up flow rates, obtain clearer filtrates, and to lower per unit costs in operation.)

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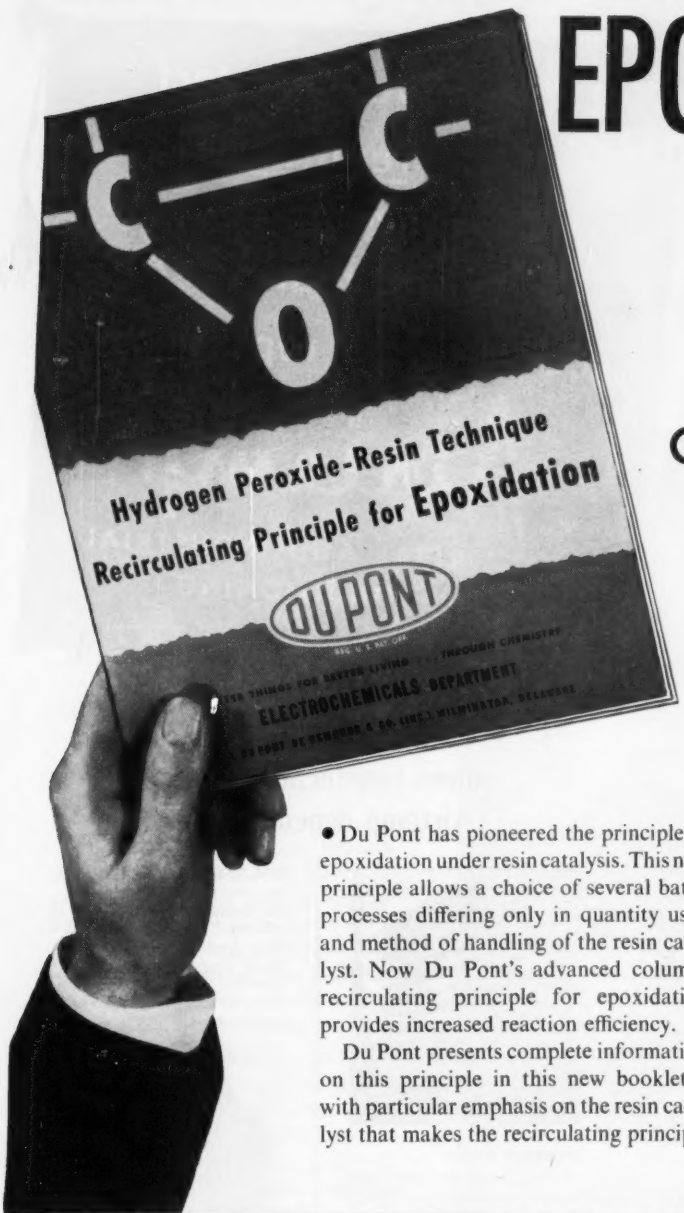
EPOXIDATION

can help you utilize fatty oil derivatives economically and safely



• Du Pont has pioneered the principle of epoxidation under resin catalysis. This new principle allows a choice of several batch processes differing only in quantity used and method of handling of the resin catalyst. Now Du Pont's advanced column-recirculating principle for epoxidation provides increased reaction efficiency.

Du Pont presents complete information on this principle in this new booklet—with particular emphasis on the resin catalyst that makes the recirculating principle possible. It also includes a summary of important reactions of the epoxides and a useful bibliography.

To the chemical manufacturers who are discovering the many possibilities for epoxides, Du Pont offers its extensive background and experience as the pioneer in resin techniques for epoxidation. Should you need more information on other reactions as well as on the possible uses of epoxides, feel free to call on Du Pont—producer of "Albone" Hydrogen Peroxide.

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Our representatives will be pleased to advise you on which is the best system for your every purpose. And whenever you specify AIRTEMP, you can rest assured your clients will be happy. They will find that operating costs are unusually low—thanks to efficient, modern AIRTEMP design.

Write for full information. For complete details on what AIRTEMP offers you, write to: Airtemp Construction Corporation, Dayton 1, Ohio.

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JENKINS Fig. 106-A

The FIRST
Renewable Composition Disc
BRONZE GLOBE VALVE
150 lbs. Steam 300 lbs. O.W.G.
⅛ in. to 3 in.

Making a Work Horse a Champion

Take a Fig. 106-A apart. It's easy to see the reason why it's the "champion" of disc-equipped Bronze Globes. Every part, from heatproof handwheel to pipe ends, reflects the design and construction skill of generations of Jenkins Valve specialists.

Jenkins Bros. introduced the first renewable composition disc Globe . . . is still the only manufacturer of both valves *and* discs.

Fig. 106-A not only looks better — it proves out better in performance. In any comparison, its long-life, low-upkeep record has always set the standard. That is the true measure of valve cost — and it is the reason why industry's shrewdest buyers will settle for nothing less than Fig. 106-A quality.

The Fig. 106-A "family", with interchangeable parts, provides Globe, Angle, and Check patterns to meet 90% of average valve needs.

Ask your Jenkins Distributor for full information, or write: Jenkins Bros., 100 Park Ave., New York 17.

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VALVES
SINCE 1864 TRADE JENKINS MARK
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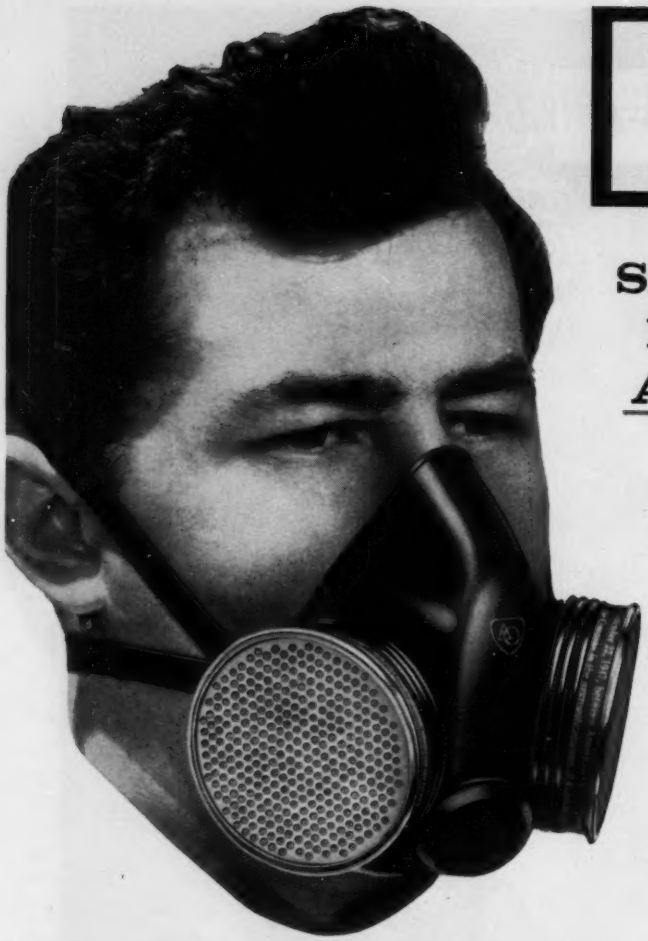

Respiratory Protection

Smaller Inventories Lower Costs with AO† R-5000 Series

14 Respirators in 1

1. R-5050. For all dusts (not significantly more toxic than lead). (BM Approval 2156)
2. R-5050A. For all dusts not significantly more toxic than lead, pneumoconiosis-producing mists and chromic acid mists. (BM Approval 2156)
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4. R-5052. For protection against acid gases.
5. R-5053. For organic vapors and gases and acid gases.
6. R-5054. For ammonia and other alkali gases.
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10. R-5058. For agricultural insecticides. Approved by U. S. Department of Agriculture.
11. R-5561. For heavy duty protection against Systox, Aldrin, Dieldrin, Chlordane, EPN, Nicotine, TEPP and HETP. (All dusts, mists, metal fumes, organic vapors) Approved by U. S. Department of Agriculture.
12. R-5562. For one or combinations of all dusts, pneumoconiosis-producing mists, chromic acid mists, metal fumes and acid gases.
13. R-5563. For heavy duty protection against metal burning fumes, acid gases, organic vapors, all dusts, mists.
14. R-5564. For one or combinations of all dusts, pneumoconiosis-producing mists, chromic acid mists, metal fumes, ammonia.

"Versatile" and "practical" are the words which best describe this highly efficient double cartridge respirator. One face mask with a variety of quickly interchangeable filter units does the work of 14 respirators. Provides real cost savings for the plant with more than one respiratory hazard! Your nearest AO Safety Products Representative can supply you with complete information on our products to help you meet your own special needs.

American Optical
SAFETY PRODUCTS DIVISION

†T.M. Reg. by American Optical Company

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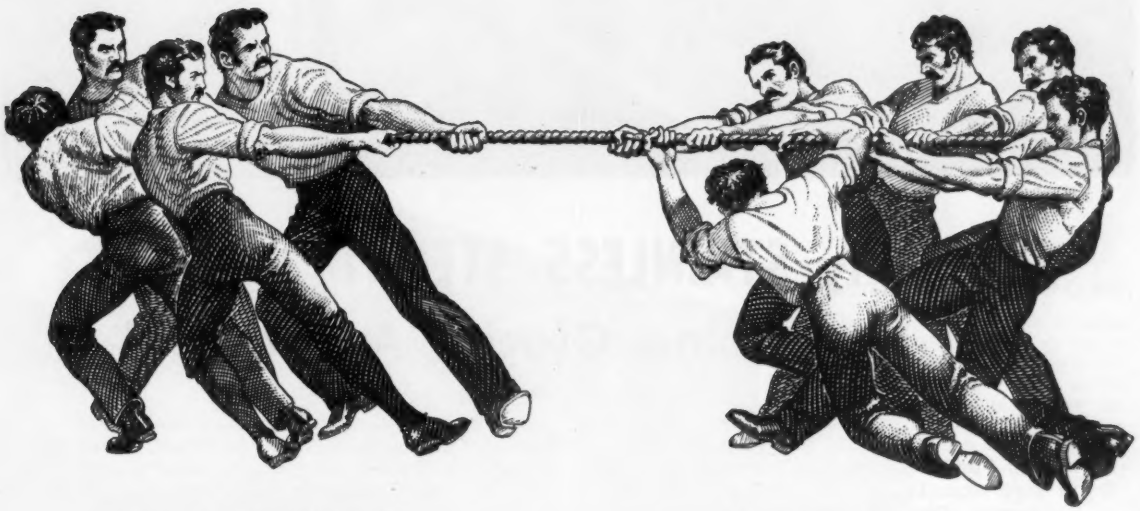
boost production
with the Ljungstrom® Air Preheater

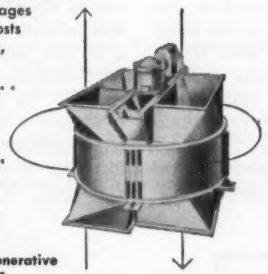
4 *of your units*
can do
the
work of 5



HOW FAST IS "WRITE OFF"?

In most cases, the Ljungstrom installation is quickly written off by increased capacity alone. Write-off time is even less when the other Ljungstrom advantages are considered — saves up to 20% of fuel costs . . . permits more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . results in consistently higher through-put . . . and minimizes slag.

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits attainable in fuel burning equipment — call or write The Air Preheater Corporation.



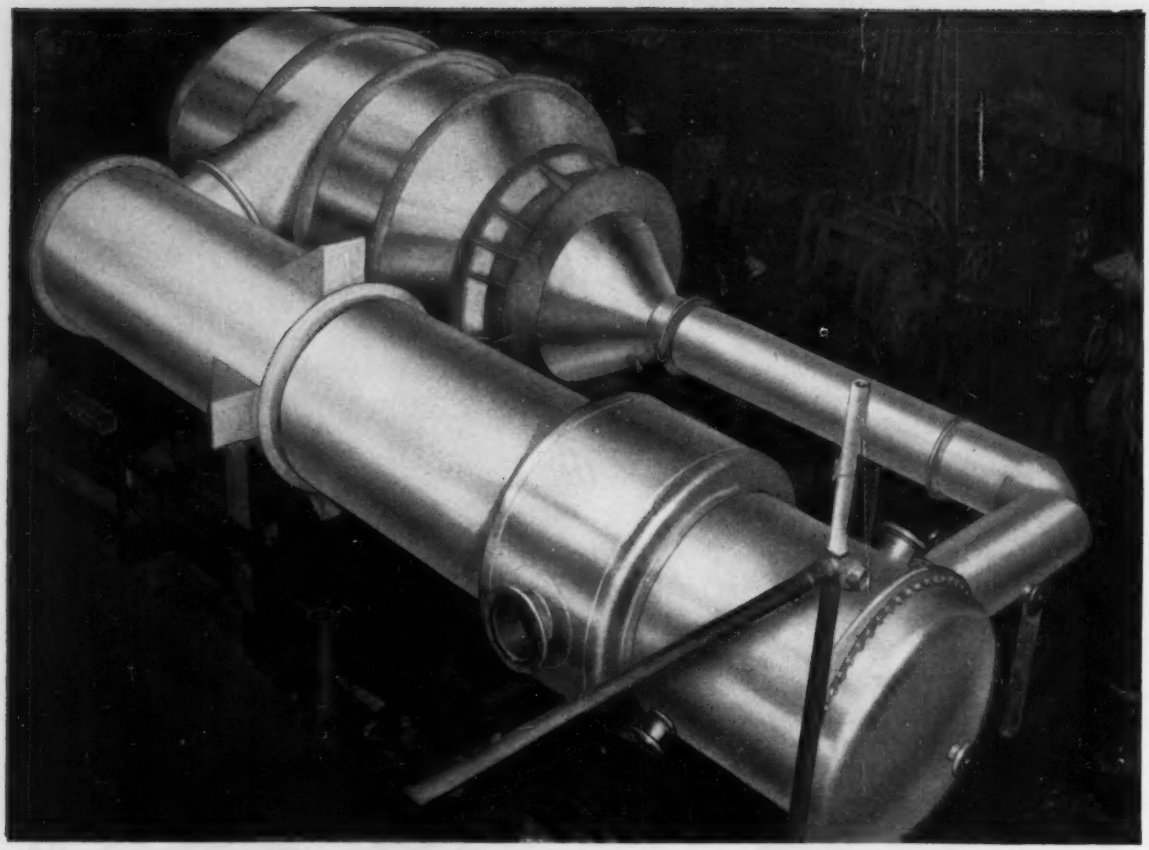
Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

Recover waste heat, return it to the furnace as combustion air, and you naturally generate higher flame temperatures . . . increase heat-transfer rates — *which means more through-put.*

That's why four of your present processing units can do the work of five *with Ljungstrom Air Preheaters increasing each unit's output as much as 25%.* One eastern refinery increased the continuous capacity of a pipe still from 16,000 to 18,000/20,000 barrels a day — by modernizing and including a Ljungstrom.

The Air Preheater Corporation **60 East 42nd Street, New York 17, N. Y.**



Why STAINLESS STEEL is best for processing Glacial Acetic Acid

This special type calandria evaporator processes glacial acetic acid. Yet its vital parts—tubes . . . liquid and vapor heads . . . downleg and centrifugal separator—are almost indestructible in this service. That's because they're fabricated of Crucible stainless steel, type 316.

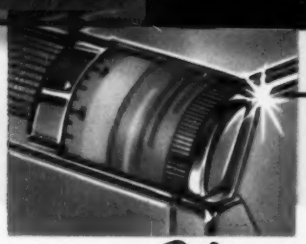
The fabricator, Badger Manufacturing Company, chose type 316 stainless because it is one of the best known alloys for handling acetic acid. It is completely resistant to acetic acid in all concentrations, and under the majority of pressure and temperature conditions. And, most important, stainless steel does not contaminate glacial acetic acid.

Its *physical* properties make stainless a wise choice, too. Its high tensile strength means minimum structural support. Its practical workability permits forming complex sections without undue trouble. And these sections are readily welded, since type 316 is designed to inhibit the precipitation of harmful carbides on cooling from high temperatures.

If you're concerned with the manufacture or use of chemical processing equipment, check the advantages offered by the 30 available types of Crucible stainless steel. Your nearby Crucible representative will be glad to give you more details. Or, for an over-all look at the many uses of stainless, write for "Making the Most of Stainless Steels in the Chemical Processing Industry." *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America



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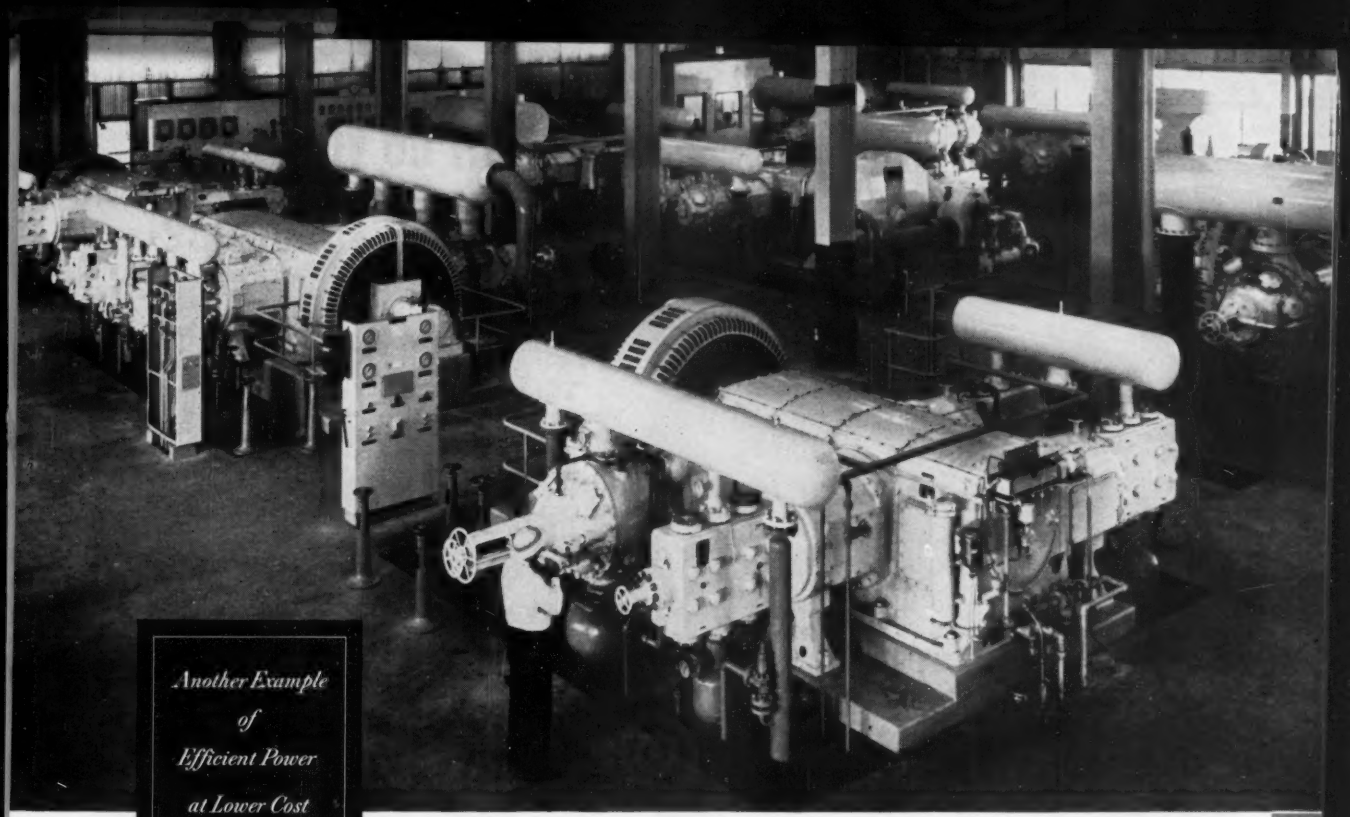


Another Example of Efficient Power at Lower Cost

This over-all plant view shows several of the compact Cooper-Bessemer M-Line compressor units that deliver dependable performance in the Brea Chemicals, Inc. modern ammonia plant near Los Angeles.

HERE'S MULTIPLE-SERVICE FLEXIBILITY IN MODERN AMMONIA PRODUCTION

. . with Cooper-Bessemer JM Compressors

● Twelve Cooper-Bessemer JM compressors, totaling 17,500 horsepower, are doing an efficient, economical job of handling a wide range of compressor services in the Brea Chemicals, Inc. 13-million-dollar ammonia plant near Los Angeles.

JM-4's for air, ammonia, mixed gas, hydrogen and recycle service, and JM-6's handling nitrogen compression, offer important savings to this producer of 235 tons of ammonia daily.

Here, to list but a few, are reasons why Brea, like so many other modern chemical producers, benefits from Cooper-Bessemer's century of compressing experience: there's extreme flexibility to handle a wide range of pressures and different gases, advanced design and metallurgy afford unusual strength and rigidity, there's five-step unloading at constant speed, the crankshaft is a steel forging of exceptionally large diameter thus low unit bearing pressures, compressor cylinder jackets are designed to insure adequate, uniform cooling, and the JM's exceptional compactness does not sacrifice accessibility or ruggedness.

If you're interested in compressing, write or call for full details . . . learn about *all* the plus features of these modern units. The nearest Cooper-Bessemer office will gladly cooperate.

MOUNT VERNON, OHIO

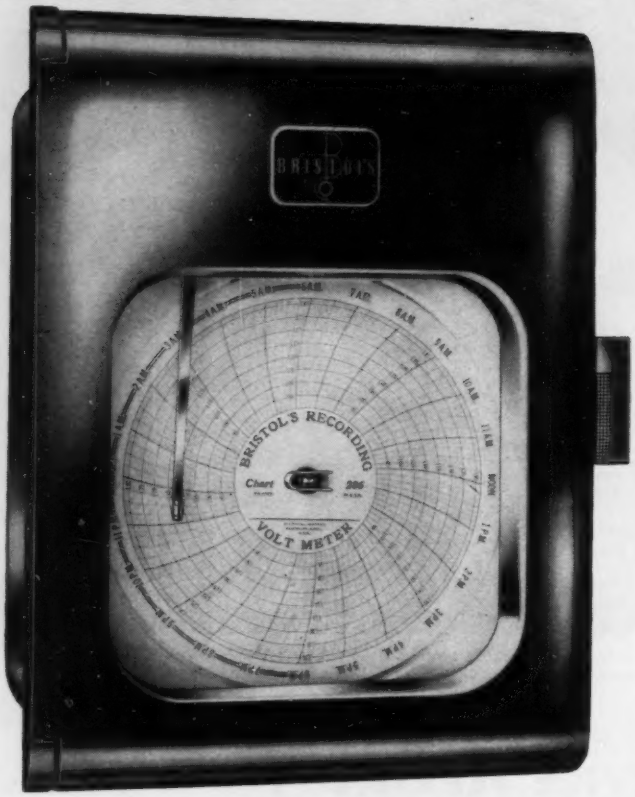
COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

WHAT'S NEWS AT BRISTOL . . .



PERMANENTLY MOUNTED Bristol Voltmeters and Ammeters come in three models: interchangeable surface and flush, surface-panel, and flush panel.

How do you pick the right recording ammeter or voltmeter?

The *right* choice for any voltage or current measurement and recording job is a Bristol Series 500 instrument.

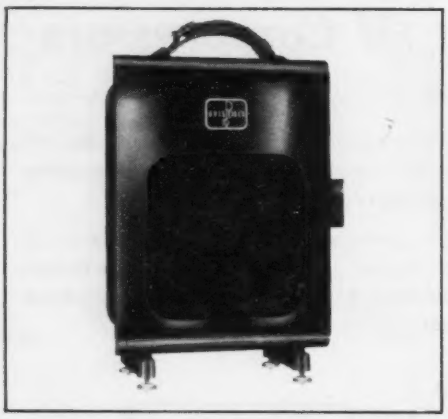
Why Bristol? Mainly because for sheer accuracy the Bristol Recorders can't be topped. Among the reasons for that are:

1. Low burden – the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensated.
4. Shock-proof moving element mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording of sudden changes – up to full scale value.

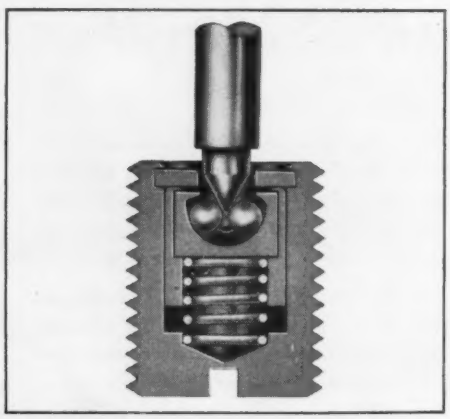
Also, Bristol's Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof cases; quick-set chart hub for each chart changing; and snap-on chart plate.

Models offered that comply with ASA Specification C39.2.

Want more facts? Write for Bulletin E1111 to the Bristol Company, 109 Bristol Road, Waterbury 20, Conn. 5.19



SINGLE AND TWO-PEN PORTABLE BRISTOL RECORDERS are offered in two models: one chiefly for portable pole mounting and the other for general portable service.

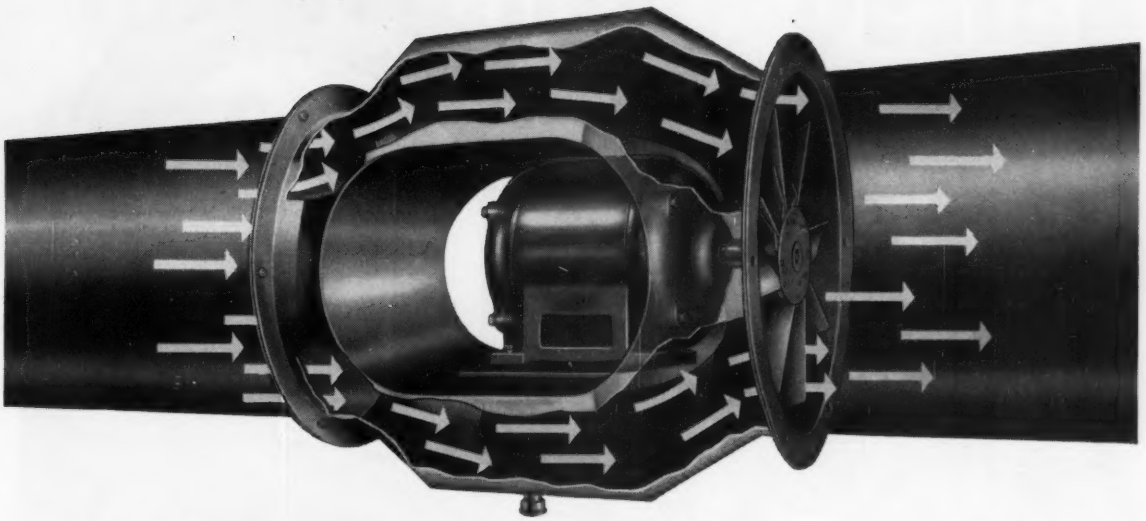


NEW BALL-BEARING SUSPENSION, loaded by a coil spring, prevents damage even under severe mechanical shock. Corrosion-resistant stainless steel ball bearings are almost tool-hard.

BRISTOL TRADE MARK BRISTOL'S REG U.S. PAT OFFICE

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

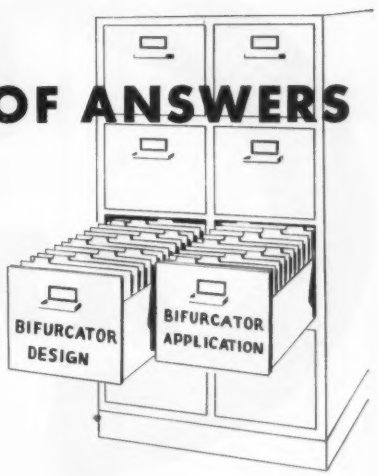


The DeBothezat Bifurcator is a direct-driven fan in a divided housing. Fumes bypass the motor which always stays clean, cool and accessible. Installs like a section of duct-work . . . vertically, horizontally or at any angle.

Got a fume problem?

WE'VE A 30-YEAR FILE OF ANSWERS

When you specify a Bifurcator®, you get 30 years experience, from two sources. Not only the experience it takes to *design* top efficiency into a split housing fan . . . but the experience it takes to properly *apply* this fan to your specific fume problem. Production tooling assures accurate reproduction of wind-tunnel tested Bifurcator units. That's why DeBothezat Bifurcator Fan performance always proves your judgment was right — for insisting on a DeBothezat Bifurcator. Send for free Catalog DB-37-55.



De Bothezat FANS

A DIVISION OF

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

DeBOTHEZAT FANS DIVISION, DEPT. CED-256
American Machine and Metals, Inc.
East Moline, Illinois

☐ Send Bulletin DB-37-55 containing complete data on the Bifurcator for exhausting fumes.

☐ Have a DeBothezat representative call.

COMPANY

ADDRESS

CITY ZONE STATE

ATTENTION MR.

for TOUGH fluid and gas handling jobs

ATLANTIC

FLEXIBLE METAL HOSE

Conveying nitric acid for use in batch nitrations is quick death for ordinary flexible metal hose. Sulphuric acid and plating solutions are other notorious killers. When temperature and pressure extremes and adverse handling conditions are also involved, hose replacement is frequent and expensive.

That's why—for tough jobs—it's good economy to specify Atlantic flexible metal process hose. Manufactured to survive the most destructive use, it is unequalled for leak-proof qualities, flexibility, durability, strength and lightness. It performs long after ordinary hose is scrapped and returns real savings in your material and labor dollar.

Whatever your application — conveying, controlling movement and vibration, correcting misalignments, compensating for expansion and contraction — *there is an Atlantic flexible metal hose that is best for it.*

Available in Seamless or Interlocking construction: Steel, stainless steel, monel, bronze. ⅛"—36" I.D. inclusive with appropriate fittings.

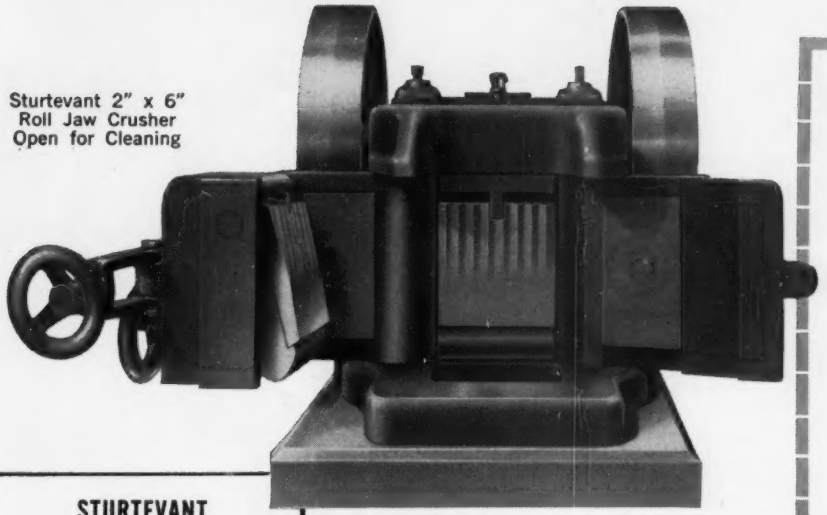
Our engineers have developed flexible metal hose for a number of classified nuclear applications. Though these types cannot be released at present, the experience gained is available for any unusual problems you may have.

Write for Chemical and Process Industries Bulletin 20D.

See our Catalogs in Sweet's Files for Product Designers and Mechanical Industries.

ATLANTIC METAL HOSE CO., INC.
329 Dyckman St., New York 34, N. Y.

"OPEN-DOOR" DESIGN CUTS SAMPLING TIME



Sturtevant 2" x 6" Roll Jaw Crusher Open for Cleaning

STURTEVANT LABORATORY EQUIPMENT

ROLL JAW CRUSHER

First choice for hard rocks. Jaw opening — 2 x 6 in. Approx. capacity: ⅛ in. setting — 700 to 800 lbs. per hr.; ¼ in. setting — 1000 to 1200 lbs. per hr.

CRUSHING ROLLS

Two sizes: 8 x 5 and 12 x 12. Outputs range from ¾ in. to 20 mesh at capacities from ¼ to 10 tons per hr. Performance varies with materials.

SWING-SLEDGE MILLS

For pulverizing soft, hard, tough or fibrous materials ranging from 1 in. to 20 mesh. Feed opening — 5 x 6 in. Capacities at 250 lbs. to 1 ton per hr. for 10 mesh, depending on materials.

SAMPLE GRINDER

Produces samples between 10 and 100 mesh with simple handwheel adjustments. Capacity up to 200 lbs. per hr. with ¼ in. or finer feed.

Small-Scale Duplication of Full-Scale Production

All Sturtevant Laboratory Equipment is ruggedly constructed. So much so that it is used in regular plants for round-the-clock operations. Exclusive "Open-Door" design makes cleaning and maintenance between sample runs quick and easy.

Preferred by laboratories that are proud of their work. Users of Sturtevant Laboratory Equipment represent the "blue chips" in industry and education. Names on request. Check the coupon for full information.

STURTEVANT

Dry Processing Equipment

The "OPEN DOOR" to *lower* operating costs over *more* years

CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
BLENDERS • GRANULATORS • CONVEYORS • ELEVATORS

STURTEVANT MILL COMPANY, 100 Clayton Street, Boston 22, Mass.

Please send me your bulletin on Laboratory Equipment ☐

Also bulletins on machines for:

☐ CRUSHING ☐ GRINDING ☐ PULVERIZING
☐ MICRON-GRINDING ☐ SEPARATING ☐ BLENDING
☐ SUPERFINE SELECTING ☐ GRANULATING ☐ CONVEYING

My dry-process materials are:_____

Desired capacity is:_____

Name_____ Title_____

Firm_____

Street_____

City_____ Zone_____ State_____

CURTISS-WRIGHT METALS PROCESSING DIVISION CAN COMBINE QUALITY WITH ECONOMY IN YOUR PRODUCTION TOO!

This nickel alloy casting by the Curtiss-Wright Metals Processing Division costs 40% less than identical previous castings. The saving, however, is almost a sidelight to the fact that specialized know-how can discover routes to quality that are often far shorter as well as less expensive.

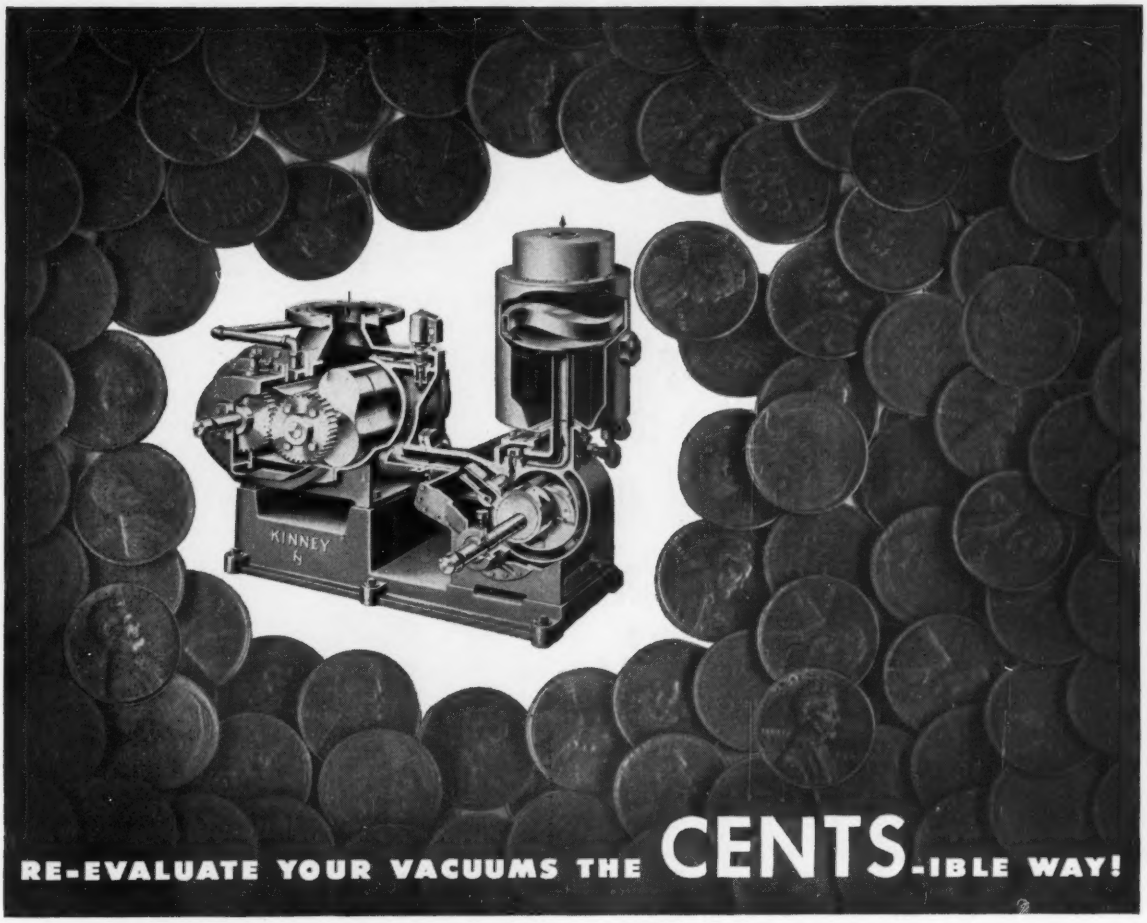
High Standards, Lower Cost

In this case the answer to meeting high standards and lower cost was ceramic mold instead of investment casting. This method in experienced hands retained the close tolerances required . . . produced castings faster, and with gratifying economy.

Metals Processing Division metallurgical specialists can find answers for you, whether in ceramic, shell, centrifugal or other techniques . . . standard or special. You will profit by long-proven engineering ability and unmatched facilities in production and testing. When requirements are critical, when precision must be combined with resistance to heat, stress, wear and corrosion, it's time to call on Curtiss-Wright—a primary source for castings, forgings and extrusions.

METALS PROCESSING DIVISION
CURTISS-WRIGHT
CORPORATION • BUFFALO, NEW YORK

70 Grider Street, Buffalo, New York



Efficiency means economy . . . and prolonged efficiency changes little savings to big ones. Remember KINNEY when you evaluate the vacuum needs of your various processing systems with efficiency in mind. The world's largest manufacturer of mechanical vacuum pumps can make your savings add up. Check the many advantages of Kinney's Model KMB Mechanical Booster High Vacuum Pump:

$ Versatility of application, easily adapted to your needs

$ Low maintenance, thorough dependability, no equipment downtime

$ Eliminates work spoilage, no liquid sealants to contaminate process

$ Works fast and clean, produces four times more vacuum pumping speed per pump horsepower than other pumps available

$ Gas ballasted second stage pump prevents internal condensation

$ No stalling pressures, easily handles sudden outbursts of gas

Clip the coupon below and send for complete technical details, or contact the Kinney district office nearest you . . . in Boston, New York, Philadelphia, Cleveland, Chicago or Los Angeles . . . and discuss your vacuum problems with a member of our competent staff.

KINNEY MFG. DIVISION
THE NEW YORK AIR BRAKE COMPANY
3551 WASHINGTON STREET • BOSTON 30 • MASS.
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N.Y.

• Please send Bulletin 400 describing the Model KMB Mechanical Booster High Vacuum Pump

Our Vacuum problem involves .....

Name .....
Company .....
Address .....
City ..... State .....

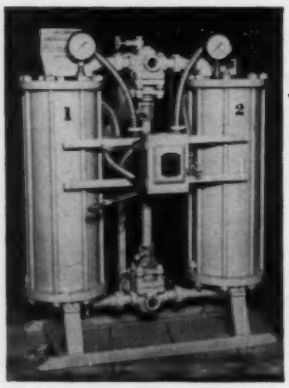
ARE YOU SURE YOU HAVE FIRE PROTECTION?

That sprinkler system may be frozen solid, even though it's only carrying compressed air

This happened five years ago—

Fire inspectors in St. Louis tested the sprinkler system in a cold storage plant and found it useless. Moisture in the compressed air that fills the piping *to prevent freezeups* had condensed and frozen at points where supply lines enter the cold rooms. Water couldn't get past this ice.

Booth Cold Storage Company, also of St. Louis, became alarmed at this report and tested their sprinkler system. The same condition existed—frozen supply lines and no sprinkler protection. So they took immediate steps to clear their lines and made certain this never happens again.



This little Lectrodryer safeguards the Booth Cold Storage Company plant against freeze-ups in their fire protection system.

Working backwards from the cold rooms to the power plant, Propylene Glycol was pumped

through one supply line after another. It took a full year to complete the task, but every pipe was freed of ice and rust.

Now a Lectrodryer* and Lectrofilter* DRY and CLEAN the air before it enters the sprinkler system. Dried to a dewpoint of -40°, there'll be no condensation to cause trouble, since the lowest coldroom temperature is -20°. The book, ***Because Moisture Isn't Pink,*** tells you more about Lectrodryers. Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

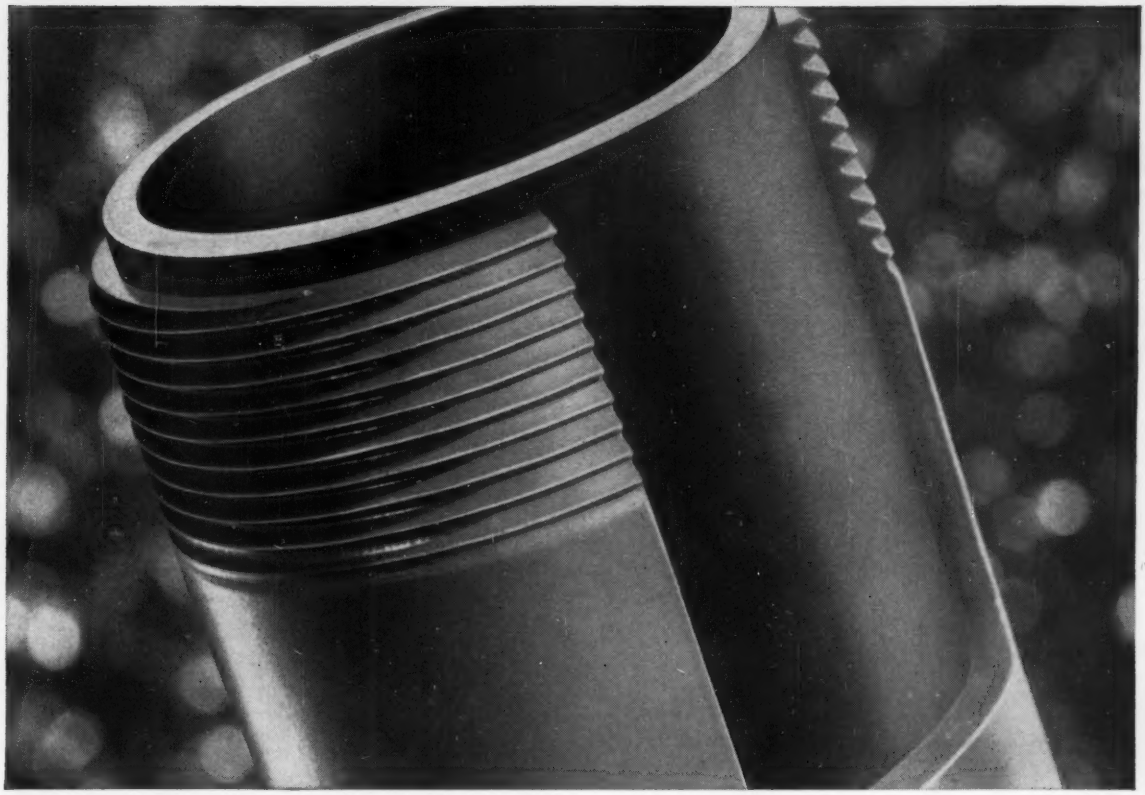
In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

DOW



You can see why Saran Lined Pipe cuts corrosion costs

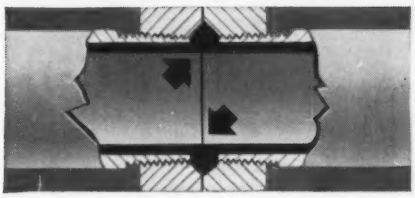
It's made of corrosion-resistant saran swaged into rigid non-bursting steel . . . liquid never touches metal in these installations

Here's your best way to convey acids, alkalies and other corrosive liquids—saran lined pipe, fittings and valves. This modern piping is corrosion resistant . . . forms snug, leakproof joints . . . is available for working pressures up to 150 psi. Fittings and valves are also available in steel for working pressures to 300 psi.

Installation costs are low with saran lined pipe, fittings and valves. Saran lined pipe can be cut and threaded in the field with available pipe-fitters' tools. Its rigidity means few supporting structures are needed.

Saran lined pipe has an outstanding record of trouble-free performance in the chemical, petroleum, waste, pulp and paper, metal finishing, and food processing industries. For further information send in the coupon at the right. THE DOW CHEMICAL COMPANY, Midland, Michigan.

Saran Lined Pipe is Manufactured by The Dow Chemical Company, Midland, Michigan



Liquid never touches metal in saran lined pipe even at a flanged connection like this.

Saran Lined Pipe Company
2415 Burdette Avenue
Ferndale 20, Michigan
Dept. SP625A

Please send me information on saran lined pipe, valves and fittings.

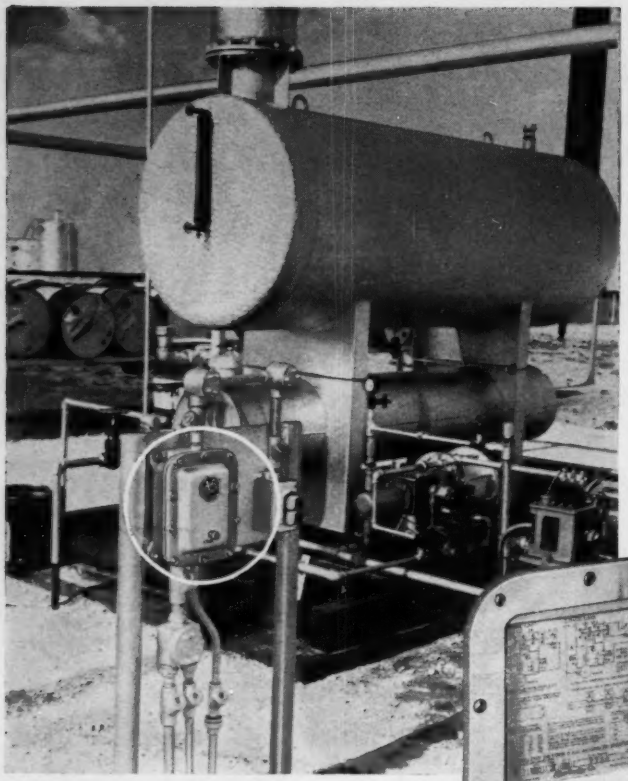
Name_____ Title_____

Company_____

Address_____

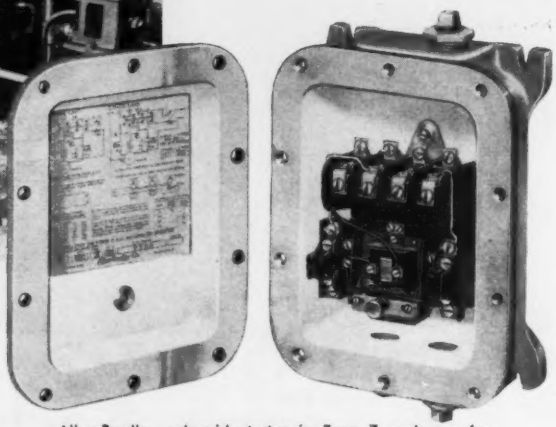
City_____ State_____

you can depend on DOW PLASTICS DOW



The Sign of
QUALITY
MOTOR CONTROL

Allen-Bradley explosion-proof starter on gas dehydrator Gycol pump in field repressuring plant in Denton Field, Lea County, New Mexico.



Allen-Bradley solenoid starter in Type 7 enclosure for operation in hazardous gas locations. All ratings use double break, maintenance-free, silver alloy contacts.

PROTECT
HAZARDOUS OPERATIONS
with
ALLEN-BRADLEY
Explosion-proof Motor Starters

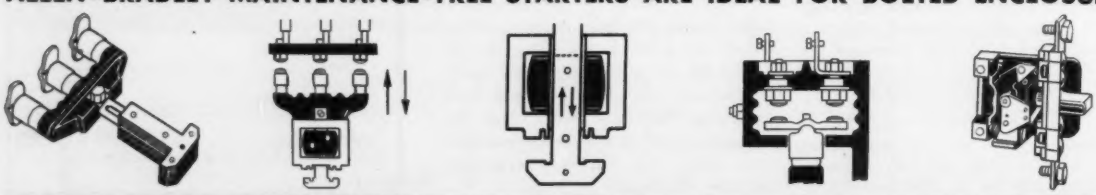
Type 7 enclosures require many bolts to provide explosion-proof protection. Inspection of explosion-proof starters is not easy; it costs labor and time.

The easiest way to beat this situation is to install Allen-Bradley solenoid starters, because they require no contact maintenance. Only on rare occasions do you have to unbolt the covers of Allen-Bradley explosion-proof starters. With only ONE MOVING PART there are no pins, pivots, or bearings to corrode and cause trouble. The double break, silver alloy contacts need no cleaning, filing, or dressing. Allen-Bradley explosion-proof starters will cut your maintenance costs.

Allen-Bradley Co., 1337 S. First St.
Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd.
Galt, Ont.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

ALLEN-BRADLEY MAINTENANCE-FREE STARTERS ARE IDEAL FOR BOLTED ENCLOSURES



ONLY ONE MOVING PART NO PINS—NO PIVOTS
One-piece plunger carries cadmium silver moving contacts. No flexible jumpers to break.

SIMPLE UP & DOWN SWITCHING MOTION
Straight line, up-and-down movement of magnetic plunger opens and closes the contacts.

NO COMPLEX LINKAGES NO FLEXIBLE JUMPERS
The magnetic plunger moves friction-free up and down in phosphor bronze guides.

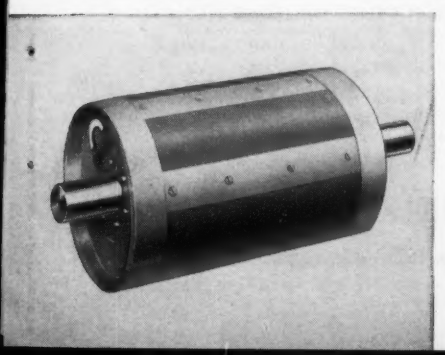
DOUBLE BREAK, SILVER ALLOY CONTACTS
The cadmium silver contacts are always in good operating condition. No maintenance needed.

DEPENDABLE THERMAL OVERLOAD RELAYS
Continuously dependable overload protection. Available for manual or automatic reset.

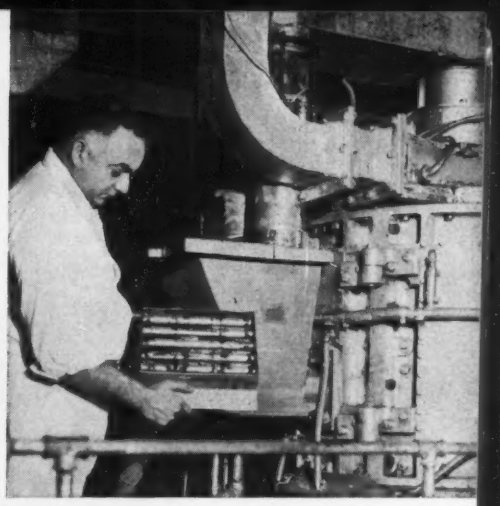
OLD IRON PANTS AND THE MAGNET! A lady from yesterday with a metal-ribbed girdle wouldn't be safe next to an Eriez Permanent Magnet. She might easily be "hung up" by the powerful Alnico V action. This idea of herculean power is practically applied in industrial processing lines. Magnets convey and control metals, and remove dangerous tramp iron preventing fires, machinery damage and product contamination. *All Eriez Magnets are non-electric, self-contained. They operate without any wires or attachments. Best of all their magnetic power lasts a lifetime. The first cost is the last.*

MAGNETIC IDEAS FROM ERIEZ

ERIEZ PULLEY WATCHES YOUR BELTLINE. The idea of this Eriez Magnetic Pulley is to reduce tramp iron . . . tramp iron which is hidden in wet or dry material passing on conveyor belts of rubber, leather, canvas, stainless steel, etc. Pulley sizes range from 4″ to 30″ diameter, in belt widths from 4″ thru 72″. The rugged construction and powerful magnetic strength of Eriez Pulleys give you trouble-free operation and efficient protection against tramp iron damage to costly crushers, grinders, pulverizers, stokers, etc. Want more information on this product? . . . request Bulletin 501.



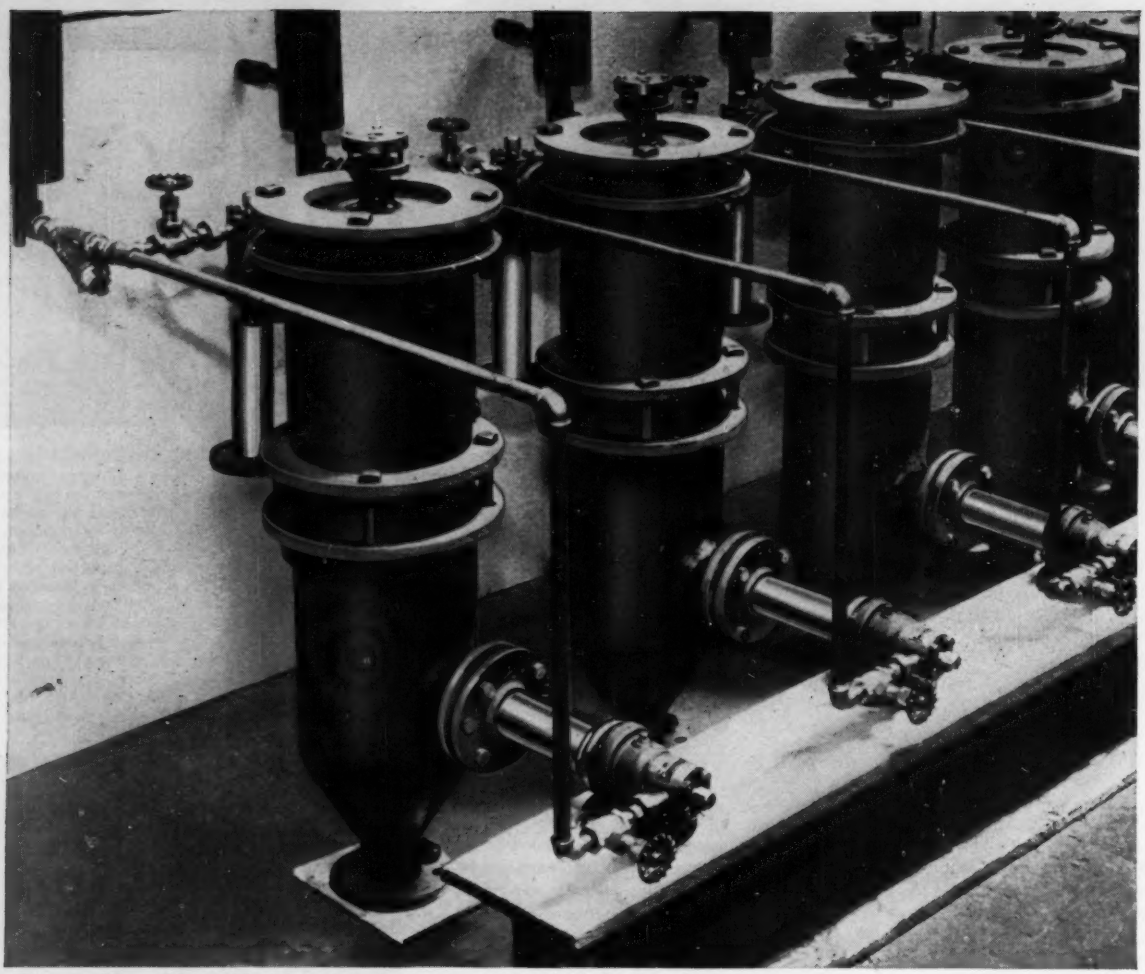
ERIEZ HI-POWR



ERIEZ GRATE MAGNET DOING SWEET JOB. *Purity* is the watchword at Boweys, Inc., Chicago concern making quality chocolate powder and syrups. Fine iron contamination and an occasional nut or bolt (tramp iron) could cause product contamination and damage the mills that grind to extremely close tolerances. To protect both product and machinery, an Eriez Permanent Grate magnet was installed in the feed hopper of a Raymond mill. It has proved very efficient; the foreman insists he would not run his mills without it. Eriez Grate magnets are so successful at removing fine bits of metal from free-flowing processing lines, that a recent quality-control test by an independent laboratory showed a single Eriez magnet removed 93% of 100-200 mesh iron.

ERIEZ DRUM MAKES BORING JOB PAY OFF. W. F. Jobbins Co., Aurora, Ill., recently solved a problem that was both expensive and troublesome. Valuable aluminum chips were being lost in iron tailings. Previously, the tailings were collected during the week and re-run on a double deck separator on the weekend, in order to salvage the aluminum from the waste tailings. Now, with an Eriez Permanent Magnetic Drum, the tailings are so free of aluminum there's no need to re-run them. This process saves 4 to 8 man hours daily. The magnet functions so efficiently, the company reports, that loss of aluminum to iron tailings is less than lab figures show it should be! Want to know what an Eriez Drum can do for you? Request 6-page Bulletin B-601.

Eriez' free booklet "Magnetic Ideas" can help you. Send for it without obligation. Address: Eriez Manufacturing Company, 74P Magnet Drive, Erie, Pa. Or, on your specific request Eriez' factory-trained field men backed by Eriez' laboratory and engineering know-how will be happy to study your particular problem, make a plant survey and offer helpful "Magnetic Ideas".



Steam jet diffusers fabricated by Schutte & Koerting Company. Cornwells Heights, Pennsylvania.

TITANIUM cuts replacements 90%

These "steam jet diffusers" create a process vacuum in pigment manufacture. And they used to be replaced every three months.

High-velocity steam and dilute hydrochloric acid formed a natural environment for cavitation corrosion and erosion—quick death for the cast iron diffusers originally used. Several alternate corrosion-resisting materials were tried, without success, until REM-CRU titanium was specified.

The first titanium diffusers were placed in service 2½ years ago. They are still going strong, with no sign whatever of corrosion or erosion—*a 1000% improvement in service life, and more to go.*

Titanium's remarkable properties explain why such improvements are possible. First, titanium is immune to attack by chlorides—and an unusually wide spectrum of other corrosives. Furthermore, it resists erosion by high-velocity fluids—and abrasion, shock and fatigue stresses. It is as strong as steel, at about half the weight, which means significant reduction in volume—and cost—of material required.

Investigate REM-CRU titanium for yourself whenever you find too-frequent metal failures under corrosive conditions. Remember, it is available in all sizes and grades—and in substantial quantities at the lowest prices ever, thanks to REM-CRU's expanded facilities and recent price reductions. So find out more about titanium—call in a REM-CRU engineer today.

To keep abreast of the latest developments on this vital metal, write to Dept. C-2 for the Rem-Cru Review—a free periodical presenting the latest technical data on titanium alloys.

REM-CRU TITANIUM

REM-CRU TITANIUM, INC., MIDLAND, PENNSYLVANIA

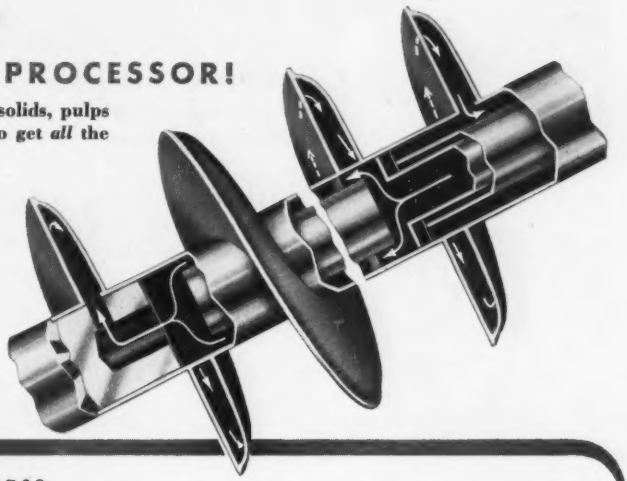
if you have a Cooling . . . Heating . . . or Drying problem

investigate the revolutionary advantages of . . .

THE holo-flite* PROCESSOR!

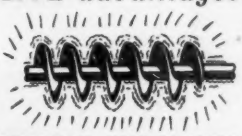
If you have processes where slurries, granular solids, pulps or pastes are cooled, heated or dried, be sure to get *all* the facts on HOLO-FLITE advantages.

HOLO-FLITE handles such processes — *in continuous flow* — in as little as 1/5th the space of other types of heat exchangers. What's more, it is readily adaptable to a wide range of applications — is simple to install and maintain — and provides many other important savings.



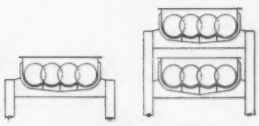
typical HOLO-FLITE *advantages . . .*

ITS APPLICATION FLEXIBILITY is almost unlimited. It cools, heats, or dries. It handles granular solids, pulps, pastes, slurries and fluids with equal ease. Its heat transfer agent can be water, refrigerant, hot oil, Dowtherm, steam or other liquids or vapors at any of a wide range of temperatures. It cools materials in ranges from 1800°F to 0°F. It heats and dries with hot oil to 600°F . . . with Dowtherm to 750°F . . . with steam to 150 lbs. per sq. in. pressure.



THE LARGE HEAT-TRANSFER SURFACE saves space — HOLO-FLITE requires as little as 1/5th the space of other heat-exchange equipment of comparable capacity. Moreover, a more complete heat transfer is effected, resulting in more uniform processing.

ROTATION IS SLOW — granular and powdered solids are handled with practically no dusting — negligible abrasion. There are no dust recovery problems — a further saving in installation, maintenance and operating costs!

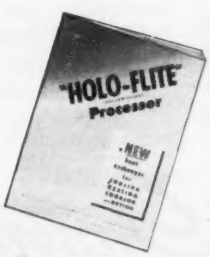


ITS OPERATING CAPACITY is readily adaptable to virtually any requirements by simply varying the diameter, pitch, and length of flights, as well as the number of "tiers." Multi-tier units require no more floor space than single-tier installations!

HOW HOLO-FLITE WORKS . . .

Basically the HOLO-FLITE consists of one or more flights of hollow-bladed screw conveyors. The product to be processed moves through a trough housing the conveyor screws. The heat-transfer fluid circulates through the hollow blades and shafts of the conveyor. The product is constantly rotated into, around, under and over the blades and shafts through which the heat-transfer fluid is circulating, assuring quick, uniform heat passage between the two mediums — *as the product is continuously moved along in a bulk-flow without interruptions!*

GET THE COMPLETE FACTS on Holo-Flite savings and how this field-proven unit can save space, time and money on your processing operations. This eight-page descriptive bulletin will gladly be sent on request. No obligation, of course!



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DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

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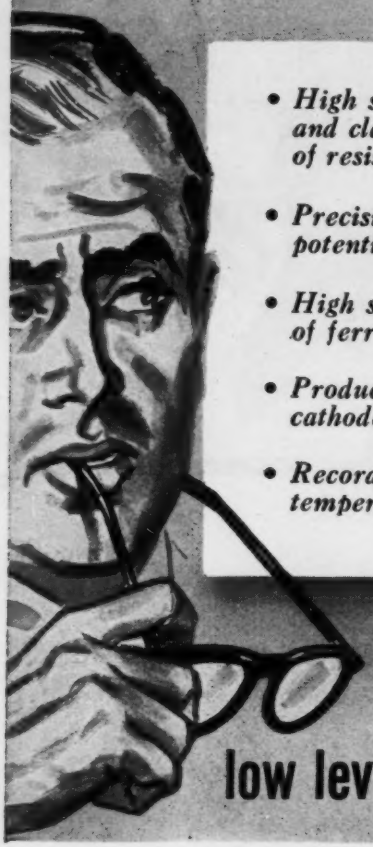
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

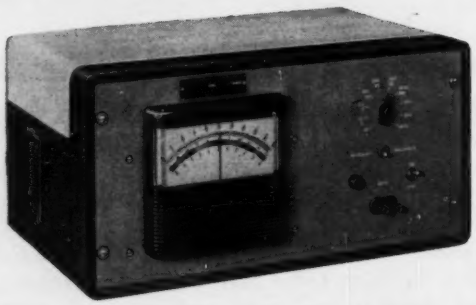
* T.M. Reg. (Hollow-Flite)

These or similar problems puzzling you?



- *High speed inspection and classification of resistive elements*
- *Precision control of minute potentials and currents*
- *High speed inspection of ferromagnetic materials*
- *Production testing of cathode ray tube brightness*
- *Recording extremely low temperature differentials.*
- *Continuously recording rate of temperature change in jet engine test stands*
- *R.M.S. regulation of a-c oscillators and generators*
- *Multiplication of two a-c or d-c signals to provide a precision product*
- *Precision low power factor measurements for production inspection of transformers and motors*

The INDUCTRONIC® SYSTEM of low level MEASUREMENT and CONTROL



Model 1475 Multi-Range Inductronic D-C Amplifier provides amplification of a complete span of direct current and voltage ranges of either polarity with no sacrifice in fundamental accuracy or speed. Has seven current ranges, from 10 to 1,000 microamperes — and ten voltage ranges, from 1 to 1,000 millivolts. All ranges immediately available by the turning of a switch; and an additional seventeen ranges become available by a knob adjustment which changes the instrument from zero left to zero center. Accuracy 1%. Accessories such as recorders and additional indicators can be inserted in the output to a total of 5,000 ohms without affecting accuracy or calibration.

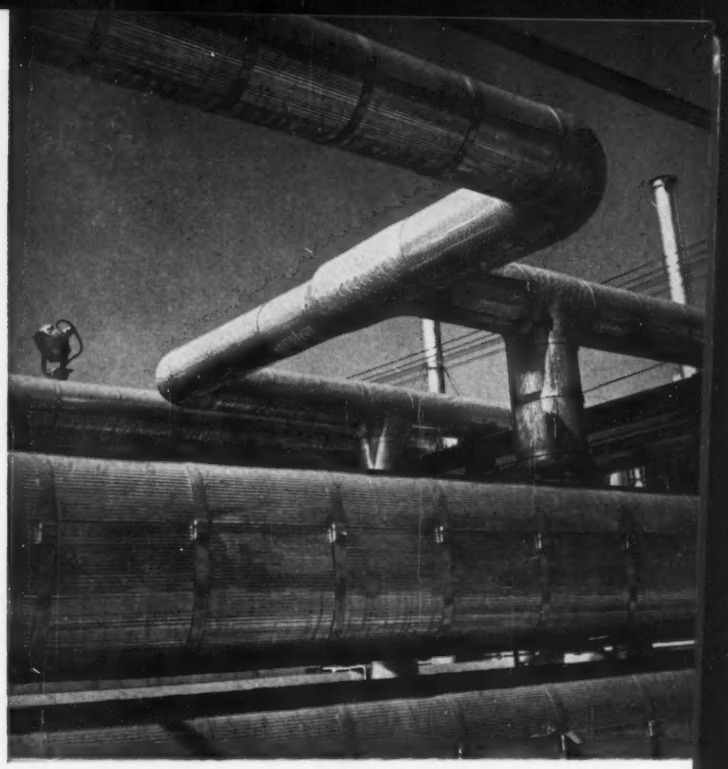
Practical solutions to the above, and many other problems of low-level measurement and control have been supplied by the WESTON Inductronic System . . . an entirely *different* method of d-c amplification. Utilizing the deflection of a permanent magnet moving coil system, it converts extremely low-level d-c to a proportionate a-c signal and amplifies it to a *usable degree* . . . then reconverts to a d-c level. The system operates at a frequency of 200 KC, and provides a high order of sensitivity, accuracy and speed. And because of circuit simplicity, the system is stable and virtually maintenance free. To learn how you can apply the Inductronic System in research or production, call your nearest Weston representative, or write direct for bulletin B-36-B.

WESTON *Instruments*

WESTON ELECTRICAL INSTRUMENT CORPORATION, 614 Frelinghuysen Avenue, Newark 5, New Jersey

How Olin Mathieson Uses Childers Jacketing For Insulated Lines

Jacketing problems at new plant ranged from covering tall towers to irregularly-shaped heat exchangers. Read how aluminum jacketing solved these problems.



More than 244,000 square feet of Childers .006" Jacketing and 35,000 square feet of heavy weight Childers Jacketing was used in this new Olin Mathieson plant to weather-proof insulated lines, towers and vessels. Close-up above shows how aluminum jacketing was applied with strapping and seals.

Low first-cost, long life, and easy installation were the big reasons Olin Mathieson Chemical Corporation used Childers Aluminum Jacketing for outdoor insulated lines in their new Brandenburg, Ky., petrochemical plant.

Mathieson used Childers standard weight Jacketing on their insulated lines. Heavier weights of Childers Jacketing were used on high towers and vessels where a stiffer material was needed to support the vertical weight of the jacketing.

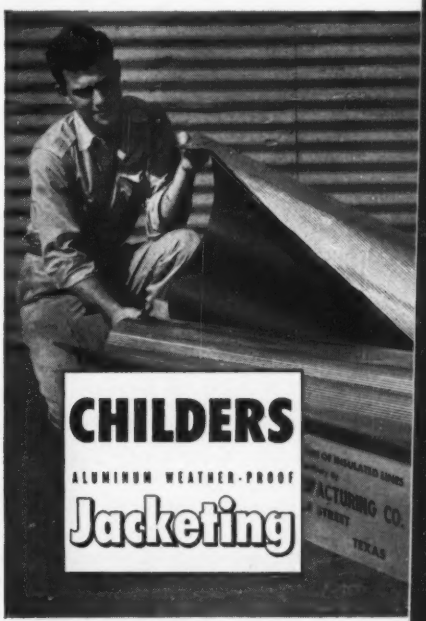
Engineers report that Childers Jacketing is inexpensive to apply. It comes in easy-to-handle rolls 4 ft. wide and 100 ft. long. Just pliers and a pocketknife are the only tools needed to apply. And because the jacketing is aluminum it needs no painting . . . stays clean and new looking even after years of service.

Childers Jacketing is easily removable, too. Just remove the strapping and jacketing can be taken off for inspection of the lines. Then same jacketing can easily be put back on the insulated line.

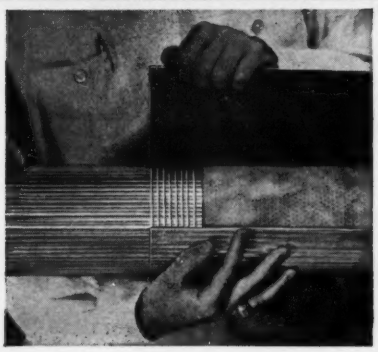
Immediate shipment from our large factory stocks can eliminate costly delays in construction or plant improvement schedules.

Try this low-cost protection in your plant. Write today for engineering data and information. You can order a 400 sq. ft. roll to test on one of your insulated lines. No obligation. Address: Childers Manufacturing Company,

DEPARTMENT CE-13
3620 WEST 11th ST.
HOUSTON, TEXAS



Only Childers Jacketing Offers LAP-SEAL



LAP-SEAL is a series of eight ribs rolled into the underlapping edge of the jacketing.

LAP-SEAL makes more positive weather seal.

LAP-SEAL saves labor—2" ribbed edge eliminates measuring for circumferential lap.

LAP-SEAL (patent applied for) is an exclusive "plus" available on all Childers Jacketing at no extra cost.

America has homework to do!

THERE'S PROBABLY a lot about your town that makes you want to brag a bit about it.

But there's one thing you *can't* be proud of. And it's a shame you share with just about every other community in America.

The homes where far too many people live are a disgrace. Slums, semi-slums, housing blight are with you. Fixing them up is the homework to be done.

If your town is like most in the U. S., here's what the figures show: 1 out of every 10 homes are rock-bottom slums. Nearly one-half urgently need basic repairs.

But slums are something that is happening on the other side of town, you may say. The problem isn't mine.

Slums are YOUR homework

Distance is no barrier against the threat and cost of housing blight.

Your taxes go up because it takes more money for your town to fight the diseases and delinquency and poverty spawned in the slums. The security of your family goes down because the slum is the natural parent of crime.

Where your business comes in

Every firm has a responsibility toward the town where it's located. Part of it is to support community improvements as any other good citizen would.

Some slums are beyond repair. They must be torn down and a fresh start made. Others can be made to conform to accepted living standards. So it is up to you to get behind every sound program which seeks to provide adequate housing for all our people.

Civic and individual groups must have business backing . . . *your* firm's backing if they are to succeed.

Follow the course of Action!

A group of Americans from every walk of life has joined together in a non-profit organization to combat home and community deterioration, A.C.T.I.O.N., the American Council To Improve Our Neighborhoods.

Send today for a free copy of "ACTION." It explains what A.C.T.I.O.N. is and proposes to do. It lists booklets, research, check-lists, and other material which can help you. Address P. O. Box 500, Radio City Station, New York 20, N. Y.

ACTION

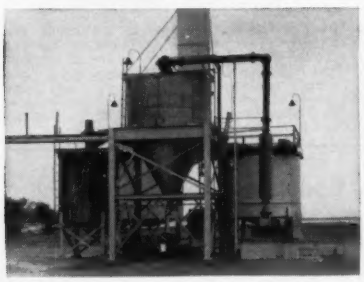
American **C**ouncil **T**o **I**mprove **O**ur **N**eighborhoods

Better flavor, better health in every bite**. . . thanks, in part, to Monel.

New table salt supplies vital "trace" nutrients

Made directly from sea water in Monel-protected equipment

Nearly everyone is familiar with the use of iodine to prevent goiter . . . fluorine to stop tooth decay . . . iron to overcome anemia.



Heat and motion complicate salt corrosion problem in evaporator (elevated) and slurry (left) tanks at Trace Element Corp. plant. Monel protects both tanks and their interior processing equipment as well.

*Registered trademark

**For more information on Trace Element Sea Salt, write Trace Elements Corporation, 718 N. Drennan St., Houston, Texas.

Experts now say other elements in trace quantities may prove equally vital to health. Copper, cobalt, magnesium, manganese, zinc, molybdenum and others.

A new type of salt—"Admiral" Trace Element Sea Salt contains these "micronutrients." Prepared for table and cooking use, it can supply them pleasantly in called-for quantities.

Hence an interesting new plant 35 miles south of Corpus Christi, Texas. Here, Trace Elements Corporation produces free flowing table salt containing 75% NaCl and 25% other minerals from sea water.

Avoids equipment corrosion problems

In designing the new plant, engineers faced two potentially serious corrosion problems... attack on interior surfaces of equipment by the highly saline stream . . . and attack on exterior surfaces of equipment by salt-laden offshore breezes.

Use of Monel* nickel-copper alloy in the more critical pieces of the plant's equipment avoids both hazards. Monel alloy is used for the evaporator tank and its submerged combustion unit . . . for slurry tank, mixer shaft and impeller blades . . . for surfaces in contact with salt in the rotary dryer and cyclone dust collector . . . for all pump impeller housings . . . and other items.

If corrosion by salts is troublesome to you, Monel, nickel, or one of the other nickel alloys may cut your problem down to size. To look into the matter, simply write:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK **NICKEL ALLOYS**

Monel... for minimum maintenance

WHERE TO BUY

5 CORROSION CONTROL SERVICES . .

You'll Find Metalweld Services A Sound Investment, Not An Expense!

1. **SYNTHETIC RESIN COATINGS** — Application of Vinyl, Epon, Baked Phenolic, Neoprene, Thiokol Coatings in the MW Plant and in the field.
2. **RUBBER LININGS** — Rubber and Koroseal Sheet Linings applied to tanks, pipe, process equipment, etc.
3. **METALLIZING** — Sprayed Zinc and Aluminum for Corrosion Protection. Metal Spraying to build up parts, rolls, shafts, journals, etc.
4. **MW PLASTICOTE LINING** — Applied to hot water tank interiors — eliminates rust — passes inspection.
5. **SURFACE CLEANING** — Sand and Steel Grit Blasting in the large MW blastrooms or in the field.

CONSULT BEFORE YOU SPECIFY
Send Us Facts or Ask for Literature!

PROTECTIVE COATINGS DIVISION

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TANKOMETER ANY LIQUID
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Send data on Engineering & Construction facilities for
ACID-ALKALI-PROOF CONSTRUCTION
of processing & storage tanks & flooring.

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NATIONAL COVERAGE

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

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Positions Wanted	Selling Opportunities Wanted	Employment Services
Part Time Work	Selling Opportunities Offered	Labor Bureaus

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Subject to Agency Commission.

$1.80 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

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Discount of 10% if full payment is made in advance for 4 consecutive insertions.

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Send NEW ADS to CHEMICAL ENGINEERING, 330 W. 42nd St., N. Y. 36, N. Y., for March issue closing February 1st

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SAN FRANCISCO
assignment

Recent design experience on petroleum refineries, chemical plants, steam power plants, or related projects.

CHEMICAL MECHANICAL

Engineers with thorough knowledge of heat exchanges, pumps, piping layouts, specification work and analysis of bids.

PIPING

Designers with drafting and layout experience on steam or process piping.

Please write furnishing complete chronological experience record and salary history. Also, full details regarding education, salary required, business and character references.

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220 Bush St., San Francisco 4, Calif.

WANTED — CHEMICAL ENGINEER

Kentucky location of national concern has excellent permanent situation in plant engineering department for graduate chemical engineer with two years' experience or less. Must have desire for early recognition of ability and performance since position open is in direct line for possible early advancement to greater responsibility in engineering or production.

No traveling required. Attractive starting salary. Excellent benefit program.

Please submit complete resume, including details of education and experience and state starting salary required. Your reply will be held confidential.

P-8868, Chemical Engineering
520 No. Michigan Ave., Chicago 11, Ill.

CHEMICAL ENGINEERS

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Interview at your convenience.
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GLADYS HUNTING (Consultant)
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Staff position in home plant of large manufacturer chemicals, rubber and adhesives. Some administrative experience or potential desirable. Starting salary $12,000. Outstanding performance will bring early recognition. Company pays agency fee and relocation expense.

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CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

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Friction products engineer or compounder thoroughly familiar with all phases of compounding and manufacturing friction materials—especially clutch facings. Reply in writing Standco Industries, Inc., P. O. Box 93, Houston, Texas, Attention J. M. Dunn.

Oxygen and Acetylene Plants Superintendent —Large oxygen and acetylene manufacturer with several plants in need of superintendent with previous experience in oxygen and acetylene gas industry. Must have engineering degree and wide experience. Location West Coast. State experience, personal background and salary required. Write to P-8542, Chemical Engineering.

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Supreme De-Lumping crushers: sales engrs., open basis, good com., leads, free tests, E. P. Miller Son, 36 Meadow, E. Orange, N. J.

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Salaried Positions $5,000 to $35,000. We offer the original personal employment service (established 46 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 553 Brisbane Bldg., Buffalo 3, N. Y.

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—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publisher to secure more advertisers and—more advertisers mean more information on more products or better service—more value—to YOU.

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with Responsibility— Challenge— Recognition

The Engineering Service Division of du Pont's Engineering Department provides other units of the company with consulting service and technical assistance in increasing capacity and yield, in reducing investment and operating costs, and in improving product quality and plant efficiency. Long-range career positions are immediately available in this division to qualified graduate engineers experienced in these specialized technical areas:

1 FILTRATION

Position requires broad and extensive knowledge of applications of techniques for separating liquids and solids, such as filtration, centrifuging, sedimentation, wet-screening, liquid cyclones, etc. Duties include: trouble-shooting on existing equipment, increasing capacity and improving performance; evaluation of alternative equipment; specification of filtration installations; and selection of auxiliary equipment such as vacuum pumps, agitation equipment, and mist separators. A major responsibility is to keep informed on latest technological advances in the field.

2 HEAT TRANSFER

Duties include: trouble-shooting on equipment, such as pipe line reactors, fluidized solids reactors, and film driers, where heat transfer is one controlling factor; selection of equipment, such as heat exchangers, evaporators, furnaces, and driers; evaluation of equipment to determine optimum alternatives; and theoretical analysis of problems in heat transfer in proposed equipment for new applications. Other typical heat transfer problems encountered involve reboilers, inert gas generators, direct fired production furnaces, and indirect fired retorts.

3 PROCESS ANALYSIS AND EVALUATION

Duties are: Assistance in the preparation and analysis of basic information for design of operating units and supporting facilities in order to obtain optimum performance with minimum investment and operating costs; preparation of flow sheets; evaluation of process alternatives; selection and approximate sizing of equipment; and establishment of heat and material balances. Position requires five or more years of experience in equipment selection economic evaluation of processes, and development of information for design of industrial facilities.

4 APPLIED REACTION KINETICS

Successful applicant will: assist research and development groups in planning experimental work to study reactions in the development of new processes, and products; recommend types of laboratory equipment, conditions for the experiments, and data to be obtained; interpret laboratory and semi-works data; and use these data to specify size and type of plant equipment and operating conditions. Will also investigate possibilities of increasing capacities and yields through modification of existing plant equipment or operating conditions.

5 NUCLEAR RADIATION

Successful applicant will assist in the application of high energy radiation in initiating chemical reactions and in altering properties of materials. Desirable background will include broad knowledge of accelerators, radioisotopes and nuclear reactors. Should be familiar with and able to develop unique manipulators, materials handling devices, economic shielding techniques, and remote controlling and maintenance techniques. Work will require familiarity with radiation hazards, employee protection methods, and use of radioactive tracers used in research and manufacture.

6 GRINDING

This position requires extensive knowledge of fine particle technology and board experience with size reduction operations and equipment. The successful applicant will be called on to provide competent technical advice on: grinding in liquid media, dust collection and screening, size classification, equipment evaluation and selection, modification of existing equipment for unusual and special grinding problems, and handling of finely ground materials. Problems encountered will provide opportunity for developing new concepts and extending the known technology.

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For appointment, please call
Mr. J. C. Costello, Jr. MAdison 9-3868

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March 4-5-6-7 (Sun-Mon-Tues-Wed)
For appointment, please call
Mr. J. C. Costello, Jr. YUkon 6-2180

Or you may send complete résumé, including details of education and experience, to:
Mr. J. C. Costello, Jr.
Engineering Department

E. I. du Pont de Nemours & Co., Inc. • Wilmington 98, Delaware

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• RESEARCH CHEMISTS

B.S. or M.S. or Ph.D. Degrees for research in vinyl acetate resins and emulsions. Organic majors preferred. Perhaps some Physical majors. Ages—20's or 30's. Experienced and recent graduates.

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Either chemists or chemical engineers in 20's or 30's are sought for this department. Experience in Organic Chemistry and/or resins helpful. Experience preferred.

• PRODUCTION

B.S. or M.S. in Ch.E. or Mech. Eng. Recent graduates or experienced production supervisors. Must like people and be willing to supervise work of others. Actually, complete charge of a small plant within a plant. 20½ to early 30's.

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M.E. or Ch.E. Degrees. Experience necessary in maintenance or plant engineering in chemical industry. Age group—late 20's through 30's. Position calls for administration of entire maintenance department of approximately 70 craftsmen and manage Stores Department.

BENEFITS:

1. Career opportunities for men willing to grow professionally.
2. Program of promotion from within.
3. Proximity to educational institutions.
4. Excellent company insurance and retirement programs.
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6. Company payment of relocation expenses.
7. Outstanding personal advancement opportunities for those who wish to grow with a Medium-sized company in midst of dynamic multi-million dollar expansion program. Shawinigan is already established as a leader in the resins and polymer fields. Send resume and salary desired.

SHAWINIGAN RESINS Corp.
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SHAWINIGAN RESINS

POWER PLANT CHEMIST

A middle east coast utility now constructing a new high pressure, pulverized fuel electric generating station offers an excellent opportunity for a working chemist who can assume full charge of modern laboratory. Must be experienced and thoroughly conversant with the analysis of water, fuel and lubricating oils. Must know water softening and conditioning in a large water treating plant, and be able to run tests and interpret test results into instructions to operators for correction of unusual conditions. Plant is located near excellent residential community. Liberal salary and outstanding employee benefits. Person selected will receive training at full pay for familiarization with plant before assuming duties. Consideration given to reimbursement of expenses incurred for moving household goods and personal effects. Include a complete resume' of experience and qualifications in first letter. Applications held confidential.

P-8300, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

WANTED
MECHANICAL ENGINEER

Opening in Engineering Department to work directly under Plant Engineer. Experience in pulp and paper manufacture required. Salaried position. Located in New York State. Reply

P-8744, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

WANTED
TECHNICAL EDITORS

To provide for its continued growth Chemical Week is seeking two additional assistant editors — preferably chemists or chemical engineers with two to three years business experience. Essential: Ability to meet people, dig out facts, interpret them intelligently and write lucidly. Please submit resume to:

PERSONNEL DIRECTOR
McGRAW-HILL PUBLISHING CO.
330 W. 42ND ST.
NEW YORK 36, N. Y.

SANITARY ENGINEER

Opportunity available for Sanitary Engineer in an expanding pulp and paper mill located in the Middle Atlantic States. Age 25-35 years. Require man experienced in Paper Mill wastes, Paper Mill stream pollution and Paper Mill Water purification. No other experience will be given consideration. Good salary and advancement. Send resume of educational background and industrial experience. All replies confidential.

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Polmerization Supervisor

Chemist or chemical engineer, heavily experienced in P.V.C. manufacturing essential. Complete charge, new plant, metropolitan New York. Position permanent, salary open. Write fully.

P-8698, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

SALES ENGINEER
LOW TEMPERATURE PROCESSING

This integrated engineering and manufacturing firm has increased its annual sales volume 600 per cent in five years to eighteen million dollars. The chemical, petroleum and metallurgical industries now depend on low temperature processing as an integrated part of their expansion plans requiring oxygen, nitrogen, argon, hydrogen, carbon monoxide, methane, and other high purity low molecular weight gases and hydrocarbons.

The company is seeking an ambitious, self-energizing, young chemical or mechanical engineer who is capable of participating in large scale contract negotiations with engineering and management personnel for the sale or lease of complete processing systems. This is an excellent opportunity to progress into management responsibility with the country's leading company in this new and rapidly growing field. Salary and profit sharing. Send application to B. H. Van Dyke

AIR PRODUCTS, INC. P. O. Box 538, Allentown, Pa.

Sales Engineer
FOR POWDER EQUIPMENT

For sub-sieve size powders, including new centrifugal classifier of outstanding performance on low micron range. Must be technical graduate with broad sales experience in the powder field. Travel required, including some abroad. Philadelphia company with established reputation in U.S. and abroad. Top quality man desired. Liberal salary, retirement, insurance, Blue Cross, etc.

P-8948, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

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NOW OFFERS DESIGN ENGINEERS

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Diversified, Original Assignments

New products with new problems are continually under development at du Pont—it is our Design Engineers who find successful solutions for the commercial production of these products. Assignments are stimulating, different, difficult—*not* repetitive.

If you are a talented graduate engineer with four or more years' design experience, du Pont has opportunity for you. And consider this vital fact—our policy is promotion from within.

Apply today to fill one of these immediate openings.

PROCESS DESIGNER-ENGINEER

Position requires experience in process and power piping arrangements, layouts and diagrams as related to chemical and petroleum industries. Experience should include basic piping fundamentals along with economical design layouts.

Principal duties will be to transform research and operating data into the design of new plants. Applicant will be expected to make independent analysis, exercise individual judgment, coordinate the work of others and make periodic trips to construction sites to assist in installation problems and start-ups.

EQUIPMENT DESIGNER-ENGINEER

Qualifications will include experience in the design of equipment for either chemical or petroleum industries. Applicant should have a thorough knowledge of the ASME Code for Unfired Pressure Vessels and be familiar with fabrication and shop practices as they affect economical design.

Successful applicant will develop and analyze unique equipment designs for use in complex chemical processes that have heretofore been untried. Periodic trips to field installations and vendor shops will be required in order to view fabrication and installation of equipment and assist in start-ups.

INSTRUMENT DESIGNER-ENGINEER

Desirable background will include experience in the application and installation of instruments for the control of chemical processes. Applicable design experience should be in pneumatic and electronic instrumentation for the measurement and control of process variables, including layout of complex graphic type panels.

Successful applicant will design and engineer systems as outlined above, giving consideration to economic installation and maintenance features. He will also assist in the development of control diagrams, prepare installation layouts and detailed hook-ups for unique application, write specifications and assist construction personnel in installation problems.

POWER DESIGNER-ENGINEER

Qualifications will include background in the design of industrial plant facilities required to supply utility services to chemical processes. Applicable design experience should be in steam generation and distribution, water supply and treatment, refrigeration, fire protection, outside pipe lines, process waste disposal and industrial furnaces.

Designers selected will design and engineer a variety of the above mentioned facilities as are required by new or existing chemical processes. Work can involve not only economic installations, but also the challenge of meeting special requirements in connection with process problems.

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4—Devine #27 double door Vacuum Shelf 17—59"x78" shelves.
1—Stokes #138-H Vacuum Shelf Dryer 10—44"x40" shelves.
2—Struthers-Wells 5'x15' nickel Rotary Vacuum.
1—Devine 5'x10' Steel Rotating Vac.
2—Stokes 30"x8', 3'x15' Rotary Vac.
1—Louisville 38x25' Rotary Steam Tube.
4—Buflovak Double Drum 42"x120", 42"x100", 36"x84", 32"x72".
2—Buflovak 6' and 3' dia. Crystallizers.

FILTERS

2—Oliver Rotary, Monel 8'x10', 3'x2'.
1—Feinc 5'x3' Monel. Rotary Vac String.
1—Feinc 3'x1', 316 S/S Rotary Vac String.
1—Swenson Rotary 4'x2' nickel.
1—Oliver 5'x3"x3' rubber lined Rotary Vac Precoat.
2—Sweetland #12, 72 and 36 leaves.
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2—Shriver 30" P&F 30 chambers.
6—Sperry 24" P&F 16 chambers.
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1—AT&M 40" Suspended, steel.
1—Bird 40" Suspended, rubber.
3—Tolhurst 40", 32", 26" Suspended, steel.
1—AT&M 36" center slung, rubber.
1—Fletcher 30" center-slung S/S.
1—Fletcher 30" Suspended, steel.
1—Tolhurst 26" Suspended, rubber.
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1—7500 gal. 316 S/S clad 12'x6'x-5'6" cone.
3—Link Belt 316 S/S 18"x12", 18"x10', 18"x7' twin screw Conveyors.

SCREENS

4—Rotex double and single deck 40"x120".
2—Rotex double and single deck 40"x84".
1—Patterson single deck 40"x84", S/S.
3—Robinson single deck 40"x84", S/S.
3—S. W. single deck 40"x84" S/S.

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2—Baker Perkins 100, 50 gal. Sigma Blades, jacketed.
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1—Stokes 3' dia. x 15' long Jacketed Rotary Vacuum Dryer
6—Double Drum Dryers: 42" x 120"; 24" x 60"; 24" x 36"; 22" x 38"
4—Rotary Hot Air Dryers or Kilns: 10'6" dia. x 105' L, 5' x 30', 4'6" x 40', 3' x 24'
3—Rotary Furnace Tubes 24" D x 8'6" L —Chrome nickel Alloy
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1—Hardinge 6' D x 22" L Conical Ball Mill, Steel Liner
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1—Penna Ring Type Granulator, Trojan K3-24, 40 HP
3—Fitz. Mill St. St., F-8, K & D
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1—Sturtevant 8 x 10 Jaw Crusher
3—Attrition Mills, 30", 24" & 16"
1—Pug Mill, St. St., two 7" dia. overlapping chambers 3'9" L. Jktd.
3—Mikro Pulverizers #2-DH, 2-TH, 3-TH

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1—Dopp 350 gal. C. I. Jack. Vac. Kettle.
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Williams #3 & 2xx Hammer Mills.
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3—Steel 3 Roll Mills 9"x32", 12"x30" & 16"x40".
3—Houchin 18"x36"; 4 Roll Granite Stone Mills.
Ball & Jewell Rotary Cutters Lab. #1 & #2.
2—U. S. & Premier 1½ H.P. Colloid Mills.

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1—Oliver Rotary Vacuum Filter, Rubber-lined, 3 ft. x 6 ft., complete.
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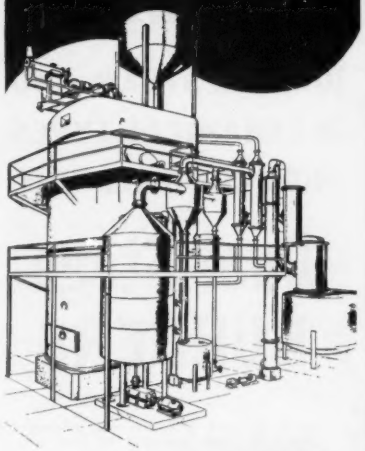

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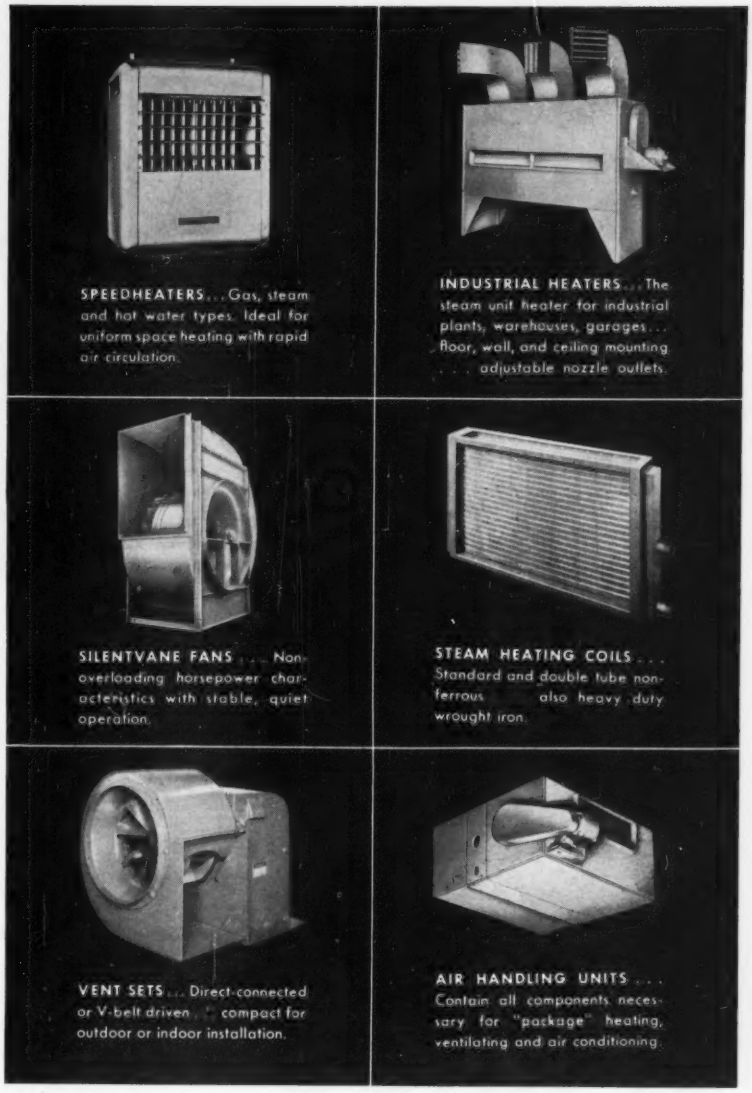
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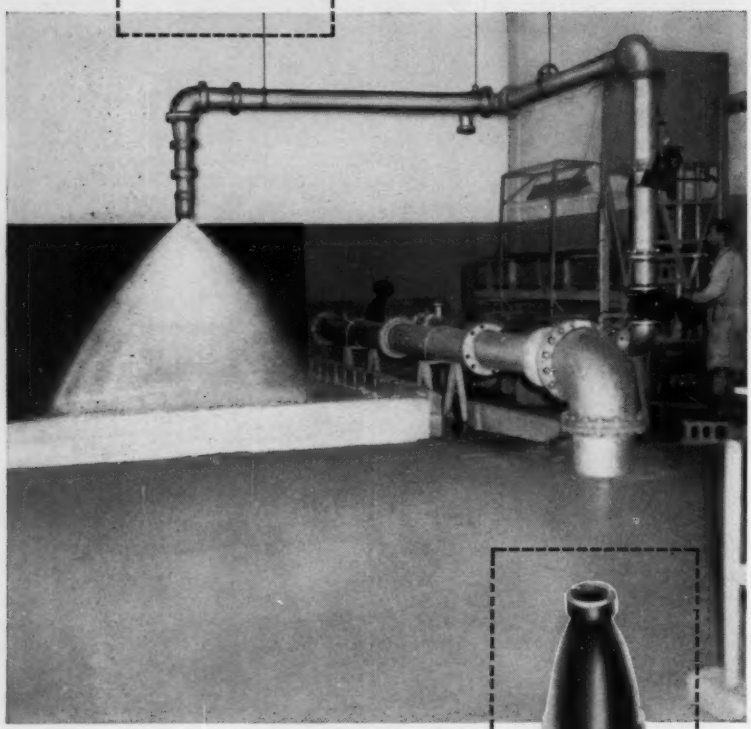

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- **Your complete index to chemicals, materials, equipment and services taken from this issue's advertisements, new products departments and "Guide to Technical Literature."**
- **Products listed feature code numbers which show the page on which they appear. L (left), R (right), T (top), B (bottom) indicate ad location; A, B, C, etc. and a, b, c, etc. identify specific product items on an editorial page or in an ad.**
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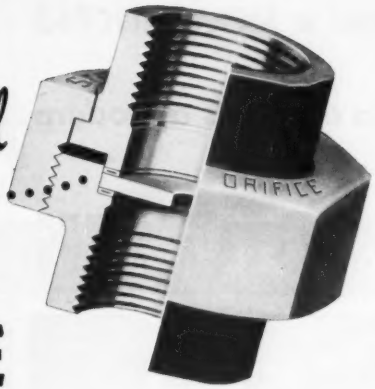

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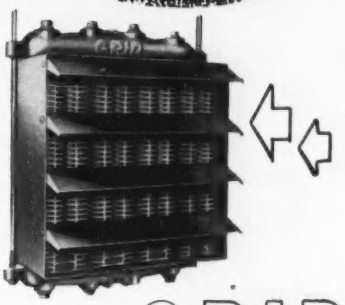

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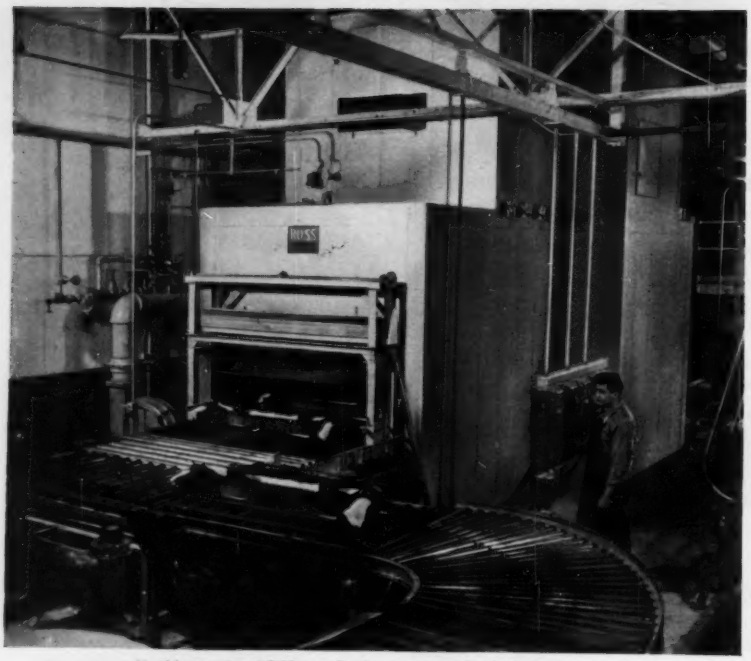

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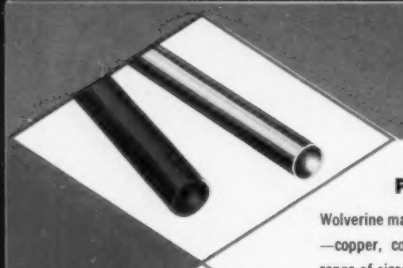

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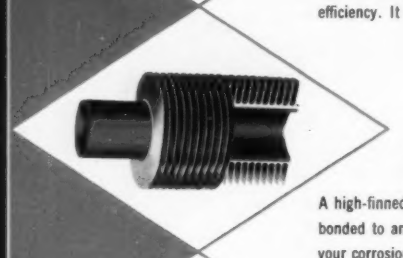
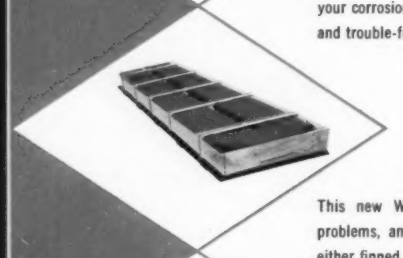
DUPLEX TYPE S/T

This tube also is designed for specific corrosive conditions. But, like Trufin, it has integral fins—will boost heat transfer efficiency. It can be used instead of prime surface tube.



TRUFIN TYPE L/C

A high-finned, lightweight aluminum tube is mechanically bonded to an interior liner of the alloy which best beats your corrosion hazard. It provides maximum heat transfer and trouble-free performance at low cost.



U-BEND PALLETS

This new Wolverine idea cuts time, reduces storage problems, and saves money. U-bend condenser tubes—either finned or prime surface—are arranged in a disposable box-type pallet in the exact order you specify. All you have to do is feed them directly from pallet to unit.

FIELD ENGINEERING SERVICE

This is a Wolverine "extra"—a staff of highly-skilled tubing technicians. You can get experienced help in solving problems dealing with alloys, corrosion, design or fabrication.

*REGISTERED U.S. PATENT OFFICE.

BACKED BY EXPERIENCE

In addition to Trufin* Type S/T, Wolverine has also pioneered in the development of a complete line of condenser tubes for the processing industry. Such a line-up could only come from years of experience—the kind of experience that studies an industry's needs and then develops products to meet those needs.

Illustrated are condenser tubes designed to bring new efficiency to every type of operating condition. Each is the product of Tubemanship—Wolverine's way of combining experience, research, rigid quality control and sound engineering into every foot of every tube.

Look these products over—study them in relation to your own operating needs—and then specify the one that will do the job. Wolverine's Condenser Tube Catalog contains complete size and alloy information. Write for your copy today!

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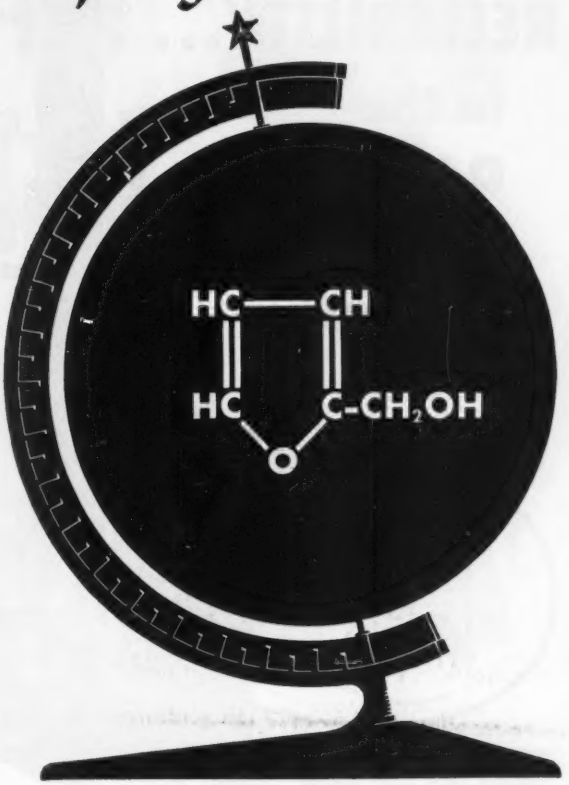
QO furfuryl alcohol



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3. Improves gap filling and craze resistant properties of urea adhesives.
4. Wets mineral surfaces.
5. Is useful as chemical intermediate.
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QO FURFURAL CHEMICALS

Write for Bulletin 205 which describes QO furfuryl alcohol, its chemistry, physical properties and uses.

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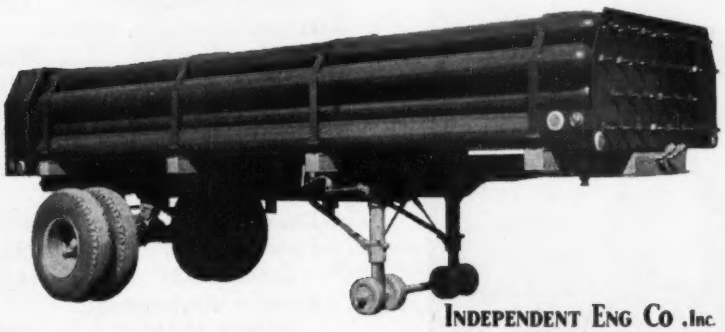

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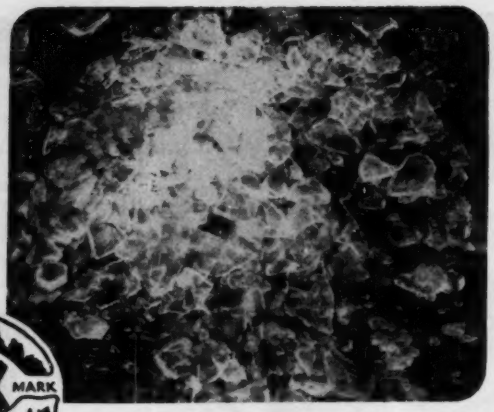

TRADE FRICK MARK

Shell-Ice Maker

If you need broken ice for any purpose—process work, storage, food service, or shipping—the facts about Shell-Ice will pleasantly surprise you.

Shell-Ice is frozen on polished vertical tubes by direct-expansion ammonia or Freon, in thicknesses of ⅛ to ½ inch, and is broken by spinners into odd-sized pieces as small as wanted. No snow, scrapings or waste, and no special cleaning required. Shell-Ice is hard and solid, and with average good water is clear.

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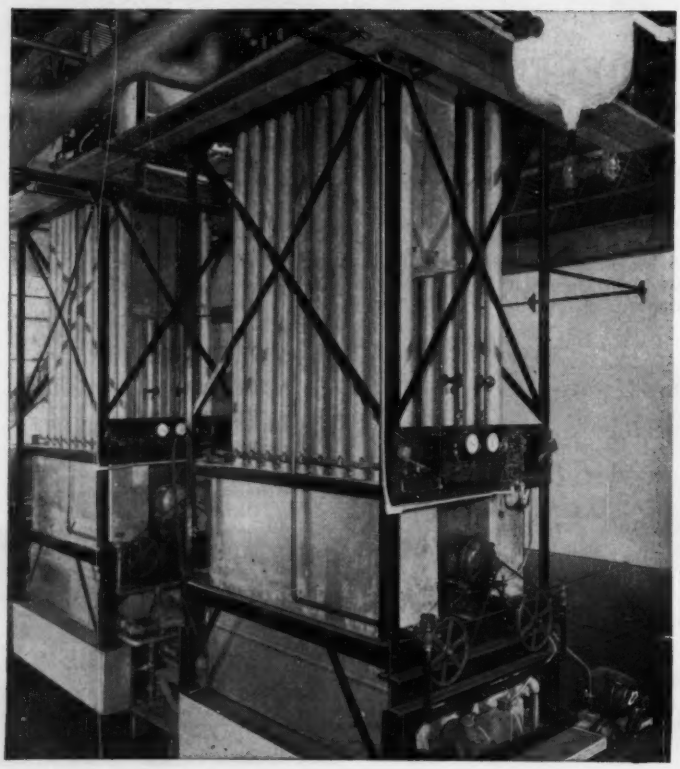
Below: Two Shell-Ice makers, each of 20 ton capacity, in operation.



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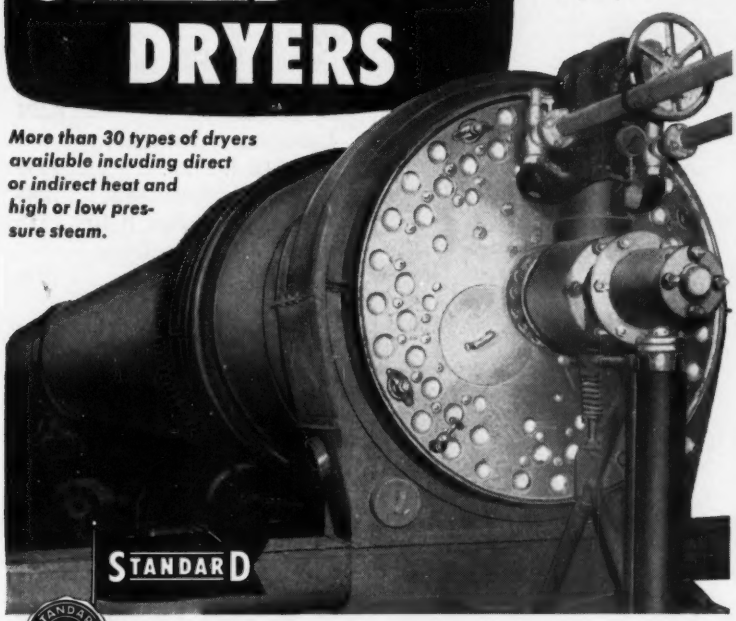

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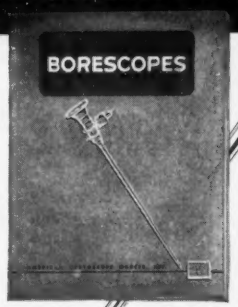

This comprehensive, elaborately illustrated booklet provides practical information on the use of the famous A. C. M. I. Borescope in various industries, for the inspection of interior areas or surfaces not otherwise visible—together with full data on the types of Borescope available, and on their care and maintenance. Have you received your copy?

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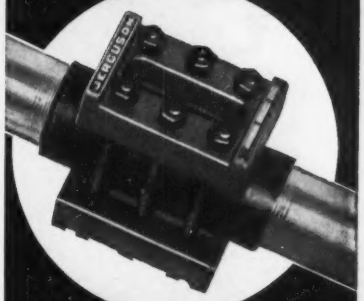
Jerguson Sight Flow Indicators



easily and inexpensively installed to show movement of liquid in pipe lines

Here is a new line of Sight Flow Indicators . . . easily and inexpensively installed in any new or existing pipe line ½" to 2" N.P.T.

The special design of these new indicators results in a turbulence in the flow of liquid, making it easily visible. Several types of indicating vanes, installed within the chamber, may also be furnished, according to variable conditions of rate of flow and viscosity of liquid. For indication of minute flows, small Sight Flow Indicators with a rotating vertical rising ball are available.

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If you have a problem of viewing the flow of liquid in a pipe line, it will pay you to investigate the new Jerguson Sight Flow Indicators today. Send us your requirements or write for Data Unit.

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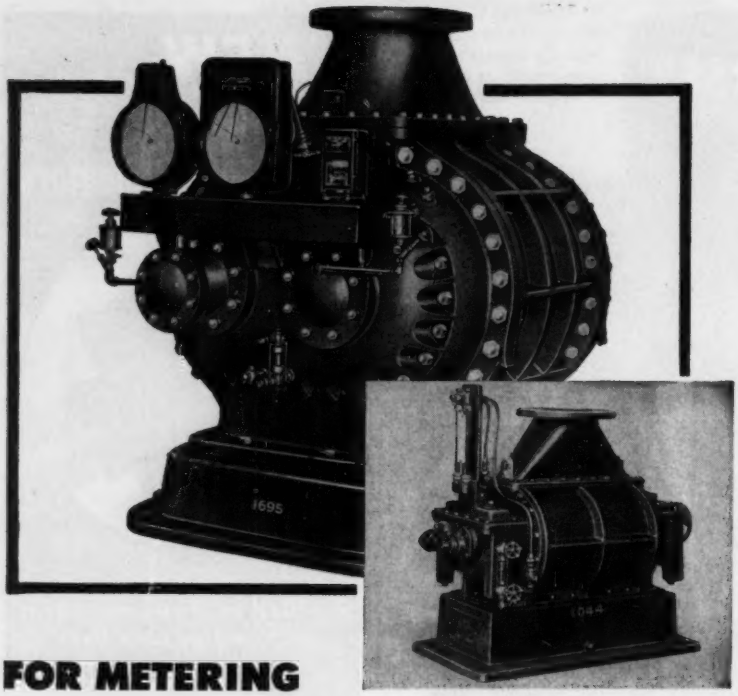

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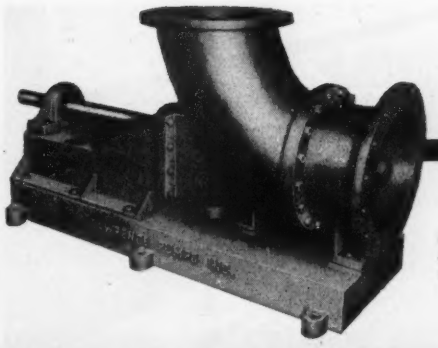
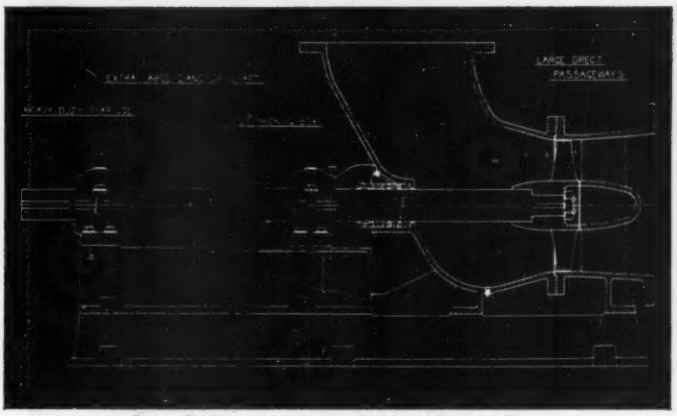


Lawrence 24" Horizontal Circulating Pump of Nickel Alloy Construction



Cross Section of Lawrence Horizontal Propeller Pump

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FOR THE
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Lawrence Propeller or Axial Flow Pumps are widely used to circulate large volumes of liquid or slurry against low heads as in evaporators, crystallizers, etc. This type of pump is particularly well adapted for circulating service because of its simplicity, high efficiency, and low first cost. The flow can be arranged in either direction and the casing turned to any position desired to serve as an elbow. The capacity can be closely regulated by varying the speed—very important in crystallization processes where a uniform velocity must be maintained.

Lawrence Propeller Pumps are made of the metals and alloys best suited for their ability to resist the corrosive and abrasive action of the liquid pumped.

Write for Bulletin 203-6 for summary of acid and chemical pump data.

LAWRENCE PUMPS INC.

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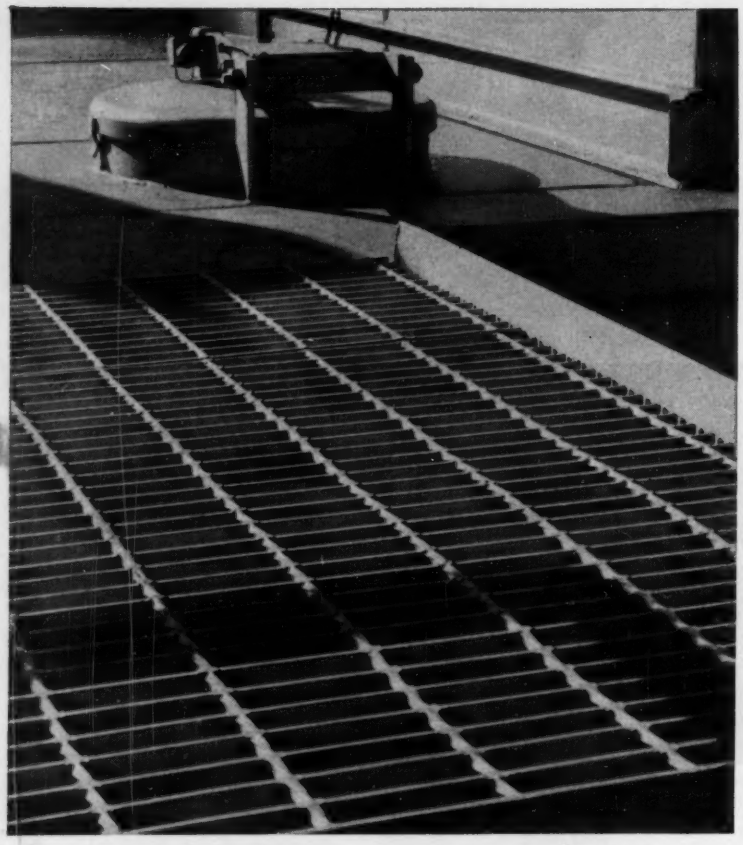

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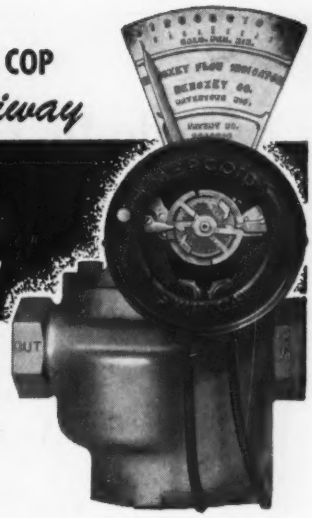

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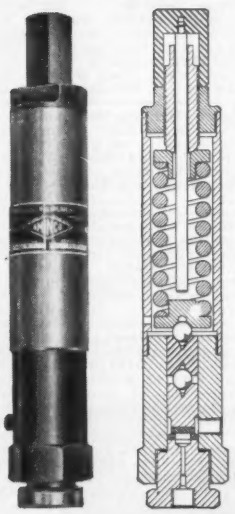

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410T Carbide & Carbon Chem.

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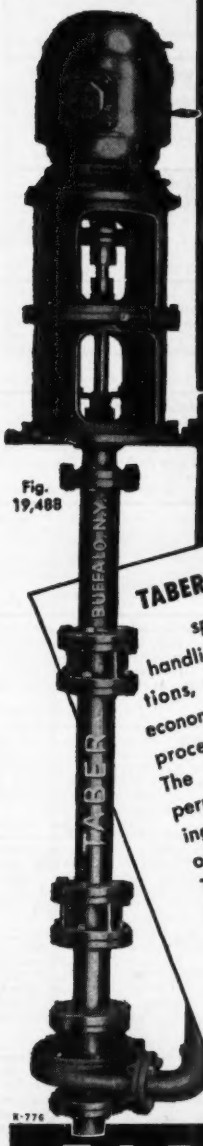

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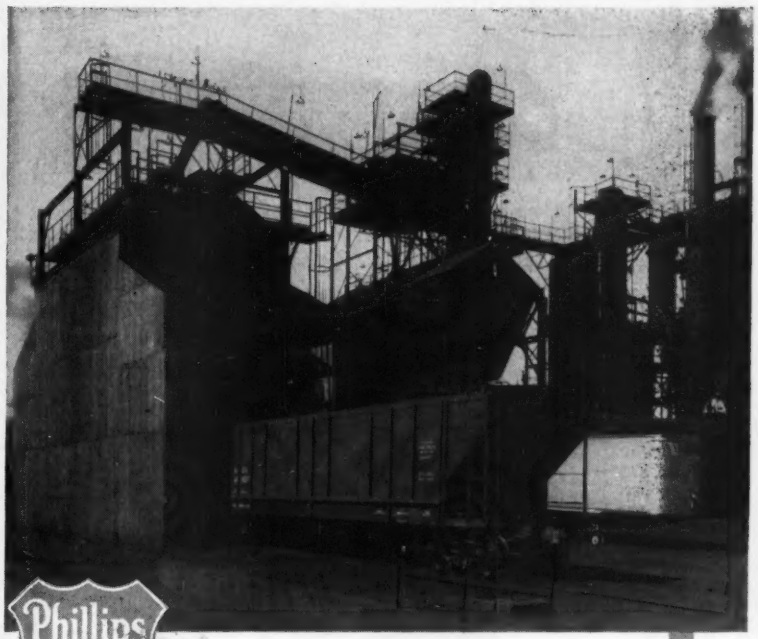

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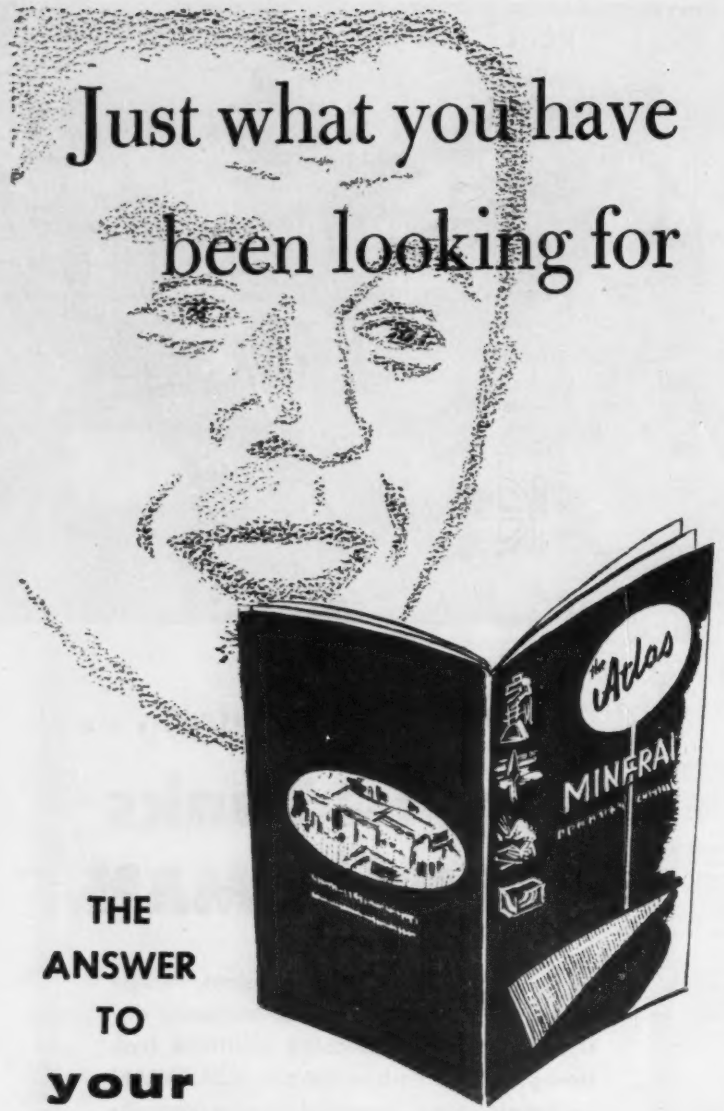

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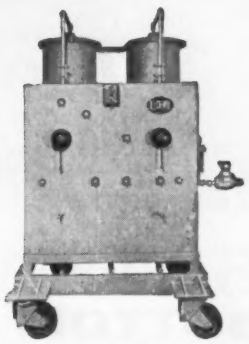

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213a *E. I. du Pont de Nemours.

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96-7 *General mills.

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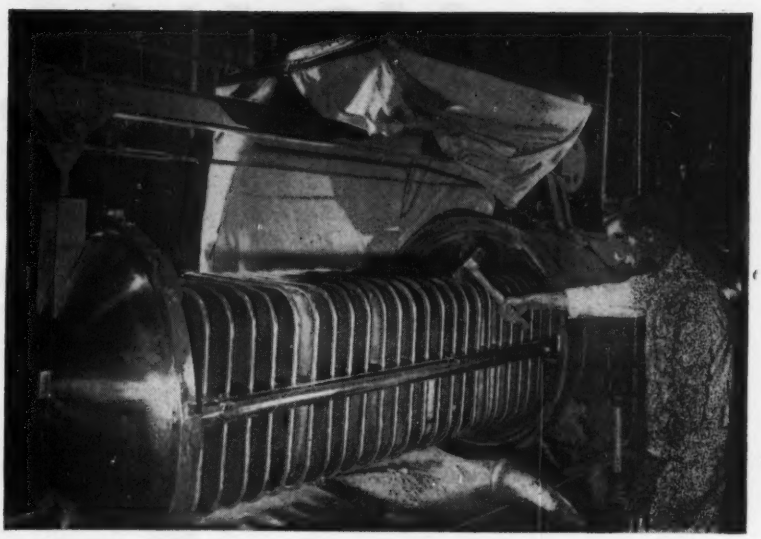

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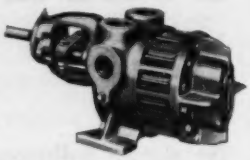
ROPER SERIES F PUMPS

Among the dependable Ropers is the Series F Pump — pressures to 300 P.S.I., sizes 1 to 300 G.P.M. It features four-port design with 8 optional piping arrangements . . . supplied in standard fitted models. With packed box or mechanical seal; with or without relief valve.

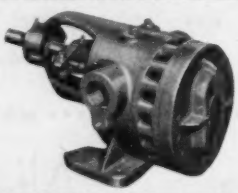


ROPER SERIES K PUMPS

Operate your hydraulic circuit with the correct size Roper for the particular job. In many cases the Series K will do, for it is rated from pressures to 150 P.S.I., capacities ¾ to 50 G.P.M. This model is compact, sturdy . . . is self-lubricated by liquid pumped. Comes with packed box or mechanical seal . . . with or without relief valve.

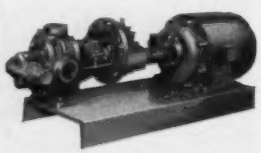
ROPER SERIES H PUMPS

Lower maintenance costs with a Roper. For instance, a pump like the Series H with pressures to 1000 P.S.I., sizes 10 to 75 G.P.M. is ideally suited for hydraulic mechanisms and for other applications requiring high pressures. Spur gears run in axial hydraulic balance . . . roller bearings and bronze wear plates reduce friction. Available with packed box or mechanical seal.



ROPER SERIES 3600 PUMPS

You'll profit more with dependable Roper Series 3600 Pumps on the job . . . they are speedy, quiet, and plenty rugged. Service-proved features such as self-lubrication, adjustable relief valve, hardened gears, and mechanical seal contribute to Roper dependability. Sizes range from 40 to 300 G.P.M.; pressures to 60 P.S.I.



GEO. D. ROPER CORP. 452 BLACKHAWK PARK AVE., ROCKFORD, ILL.

SEND NOW FOR DESCRIPTIVE BULLETINS

ROPER *Rotary Pumps*

LITERATURE . . .

Soda, Caustic.....“Caustic Soda Buyer's Guide” contains helpful facts on economics of 50% & 73% solutions; other forms of caustic soda; capacities of tank cars & other containers; useful shipping data; etc.
73b *Hooker Electrochem Co.

Sodium Benzoate.....In perishable food products, sodium benzoate offers low-cost insurance against bacterial action. For details of this assured protection, request leaflet, “Preserving with Sodium Benzoate.”
416A Monsanto Chem. Co.

Sodium Borohydride.....MH sodium borohydride, $MaBH_4$, will reduce esters, acids, acid anhydrides, and acid halides. Announces the availability of detailed Bulletin 502-F and typical reduction procedure.
431a *Metal Hydrides.

Sodium Citrate.....Complex-shaped interiors can be successfully plated without electricity by electroless nickel plating using Pfizer sodium citrate. Request Technical Bulletin 68, “Electroless Nickel.”
121a *Chas. Pfizer & Co.

Sodium Hydride.....A powerful drying agent for hydrocarbons, ether & amines. Reduces metallic oxides easily . . . affords an excellent method for preparing exceptionally pure alcoholates. Request Fact Sheet.
416B Ethyl Corp.

Sodium Lignosulfonate.....Polyfon . . . a sodium lignosulfonate . . . imparts strength and stability to chemical foams. Polyfon may be applicable to your foam problem. Samples & Bulletins 301 and 304.
416C West Va. Pulp & Paper Co.

Sodium m-Silicate.....Valuable data on Drymet anhydrous—the most highly concentrated form of sodium m-Silicate. Drymet File Folder contains complete technical information and suggested formulations.
BL399 *Cowles Chem. Co.

Solvents.....You can select the right solvent or solvent combination from Carbide's series of esters, ketones, glycol-ethers, and alcohols. Solvent Selector offers data on solvents, plasticizers, etc. 6 p.
416D Carbide & Carbon Chem.

Solvents, Aromatic.....Cover a very wide evaporation range. Their individual characteristics satisfy specific requirements in a great variety of formulations. Booklet contains detailed specifications.
416E Shell Oil Co.

Stearates, Metallic.....Manufacture under rigid controls provides assurance of a consistent product. Request booklet on Aero metallic stearates, containing Typical Analysis Data and Methods of Analysis.
416F American Cyanamid Co.

Stearates, Metallic.....New 36 p. booklet outlines properties & uses of metallic stearates for the information of purchasing, technical & executive personnel of 20 industries. Request Bulletin No. 55-2.
416G Witco Chem. Co.

Sulphur Dichloride.....Paints passed thru sulphur dichloride vapor dry in from 2 to 20 seconds. This drying process works on paper, wood, cloth, metal, glass & plastics. Full data & samples are available upon request.
73c *Hooker Electrochem. Co.

Sulphur Dioxide.....A versatile chemical reagent for industry, sulphur dioxide can be used as a reducing or bleaching agent, preservative, antichlor, neutralizer, pH control. Details in “Virginia SO_2” Folder.
24 *Virginia Smelting Co.

Surface Active Agents.....Highly surface active when used alone in aqueous systems, the Surfynols in conjunction with most other surface active agents give improved performance. Technical Bulletin.
416H Air Reduction Chem. Co.

* From advertisement, this issue

Now turn to the back . . .

Simply circle the code numbers desired on the handy pre-paid postcard, and mail it to us. Replies will reach you direct from the companies manufacturing the products.

Surface Active Agents.....Presents an 80 p. "Guide to Formulation of Industrial Emulsions with Atlas Surfacants" . . . for polishes, lubricants, cutting oils, cleaning compounds, resins, paints, etc.
417A Atlas Powder Co.

Toluene.....Industries using new high purity Sun Toluene report increased plant efficiency—better quality in their finished products—increased life of many of their catalysts. Technical Bulletin No. 27.
417B Sun Oil Co.

Tributyl Phosphate.....In rubber base paints, effectiveness of tributyl phosphate as an anti-foam agent has been proved by manufacturers who now use it in their formulations. Technical literature & sample.
417C Ohio-Apex Div.

Trimethylolethane.....TME — Heyden's Trimethylolethane—for alkyds, polyesters, isocyanate resins, and drying oils. TME is shipped in handy 50 lb. multi-wall bags. Technical Bulletin and samples on request.
417D Heyden Chem. Corp.

Tripentaerythritol, Technical.....Tripentek (tripentaerythritol, technical) is fully described in 16 p. reference—formula, specification, properties, solubility, uses, etc. Technical Bulletin PE 3-55.
417E Heyden Chem. Corp.

Tris (Hydroxymethyl) Aminomethane.....See what highly reactive nitroparaffin ("Tris Amino") derivative can do for you—the only tri-hydroxy molecule commercially available havinf a primary amine group. Data & samples.
149 *Commercial Solvents Corp.

Waxes, Petroleum.....Cardis One is one of the many new waxes developed by Warwick to provide manufacturers with formulations that answer the growing consumer demand for wax-rich polishes. Data & samples.
417F Warwick Wax Co.

Waxes, Synthetic.....Acrawax C synthetic wax (M.P. 140-143°C) for: lubricating plastics & elastomers; raising melting points of waxes, asphalt, etc.; waterproofing electrical insulation; etc. See Catalog.
417G Glyco Products Co.

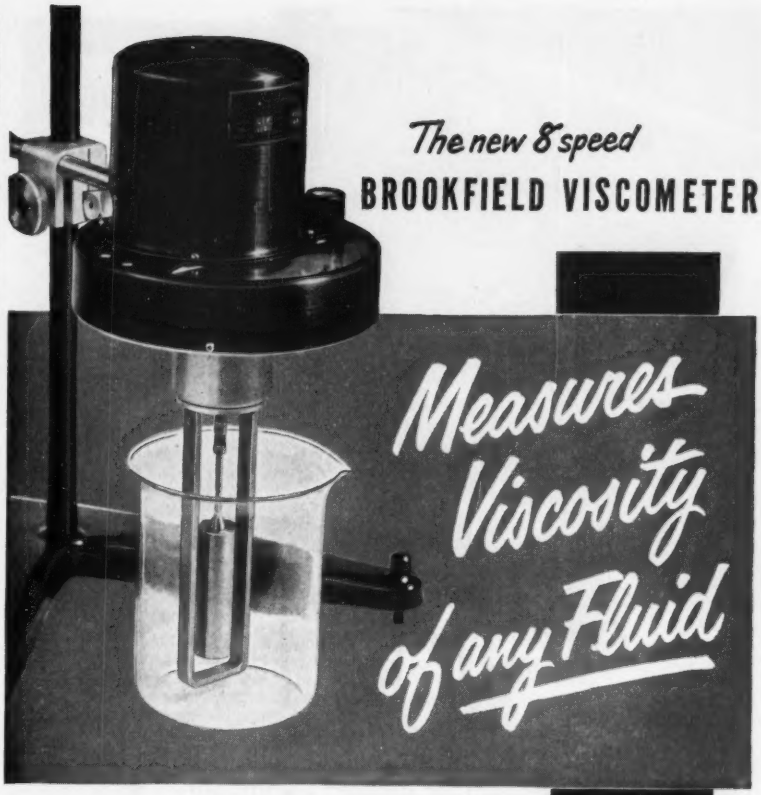
Construction Materials

Alloys, Hardsurfacing.....Describes newly developed line of hardsurfacing alloys. These materials consist of alloy-filled tubes, either in coils for automatic welding, or cut to length for manual application. 9 p.
417H Coast Metals.

Castings, High Alloy.....Covers facilities for producing high alloy static & centrifugal castings & offers data on castings used for resisting high temperatures, corrosion & abrasion. Bulletin No. 3354-G.
436 *Duraloy Co.

Ceramics, Chemical.....Today's chemical ceramics feature superior characteristics: better heat-shock resistance; higher mechanical strength; closer dimensional tolerances. Bulletins C-5 & CP-50. Request.
104 *U. S. Stoneware Co.

* From advertisement, this issue



foods
toothpaste
resins
coatings
paint
sizings
molten glass
asphalt
solvents
greases
inks
latex
oils

With the new portable Brookfield *eight-speed* viscometer you can, *at the flick of a switch*, easily measure the viscosity of any fluid . . . readings down to 1/5 of 1 per cent with materials having viscosity of from 1 to 32 million centipoises.

If speed, accuracy, and versatility count with you, demand the new Brookfield eight-speed viscometer. A complete line of accessories makes the Brookfield adaptable to any viscosity measurement problem. Your prompt inquiry will bring complete information. Technical assistance available without obligation.

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STOUGHTON 23, MASSACHUSETTS

Send the facts to:.....

WOW!

You pay no premium for Ampco* Centrifugal Pumps — the pumps that resist corrosion, erosion, and are easily adapted to changing demand

First of all, you can get an Ampco Centrifugal Pump in any alloy you want, with high efficiencies, to give you the maximum resistance to corrosion and erosion your process requires.

You save on power too, because Ampco Pump efficiencies remain high under the most adverse conditions. There are no unstable curves in the Ampco Pump family.

And, if you're faced with changing demands, and you have to run your pump "off rating," an Ampco Pump will fulfill your conditions. You get a pump that saves you money — money on shaft breakage, bearing failures, seal breakage, fretting, etc.

Here's why! Ampco Centrifugal Pumps give you numerous combinations. You can get the exact shaft you need, including standard, heavy, extra-rigid and two-piece designs.

You can select the bearings you want — sealed, replenishable grease, or oil-lubricated, single and double widths.

You can choose your shaft seals — inside or or outside mechanical seals; internal, external, or flushing-packed stuffing boxes.

You can pick the pedestal height and type of impeller you want.

And here's another saving — you don't have to buy a new pump when your conditions change. Thanks to the versatility of Ampco Centrifugal Pump design, you can make modifications in the field — quickly and inexpensively.

It pays to use Ampco Centrifugal Pumps in your tough spots. Speeds — 1750 and 3500 rpm. Capacities to 600 gpm. Heads to 300 ft. Write for latest literature.

*Reg. U. S. Pat. Off.

AMPCO METAL, INC.
Dept. CE-2
Milwaukee 46, Wisconsin
West Coast Plant • Burbank, California

P-15

LITERATURE . . .

Coatings, Protective.....Literature Folder includes booklets on: Rowe's Polyvinate Coating System; Rowe's Neoprene Coating System; Rowe's Asphalt Coating System; Rowe's Rocrolite Coating System; etc.
418A Rowe Paint & Varnish Co.

Coatings, Protective.....Two new, illustrated catalogs cover Ameresat method of corrosion control. One is for the industrial construction field, the other for plant maintenance engineers. Nos. 3i/Am & 3j/Am.
418B Ameresat Corp.

Concrete, Gas.....Company announces the availability upon request of a new, profusely illustrated reference containing detailed information about the properties, production and use of Durox gas concrete. 12 p.
418C Skövde Gasbetong Aktiebolag

Electrodes, Tungsten.....Makes available a valuable technical reference on Premium Quality tungsten electrodes for helium, argon and hydrogen arc welding. Request your copy of Technical Data Bulletin 14.150.
418D W W Alloys.

Fabrication & Erection, Piping.....New facilities brochure pictorially illustrates Mercury Piping Company operations in fabrication and erection of low and high pressure piping. Copies available upon request.
418E Mercury Piping Co.

Fabrication, Metal.....Booklet, "Facilities & Products," with information & photographs which show why company can turn out—at low cost—specialized heavy equipment for chemical plants, available upon request.
58 *Newport News Shipbuilding.

Insulation, Cellular Glass.....Gives you the maintenance-free insulating performance you need for your piping, tanks, spheres and other industrial equipment. Request product booklets & "Foamglas" sample.
278-9 *Pittsburgh Corning Corp.

Insulation, Polyethylene.....Bakelite Polyethylene Insulation for Heavy Construction Power Systems," Kabelitems No. 81, includes data on the Dalles Dam Project. Cites advantages of using polyethylene insulation.
418F Bakelite Co.

Insulation, Tank.....Ultralite, the only insulation of long textile-type glass fibers, is the fastest & cheapest way to insulate heated equipment. Request samples, prices, specifications, & suggested application methods.
227 *Gustin-Bacon Mfg. Co.

Linings & Tile Tanks.....Designed & installed to meet the exact chemical & physical requirements of each installation, Stebbins linings & tile tanks are famous for their efficiency & economy. Request Bulletin A-153.
319 *Stebbins Engrg. & Mfg. Co.

Materials of Construction.....A new 16 p. bulletin on corrosion proof materials of construction filled with valuable information on 18 materials that can be used to give you plant-wide protection from corrosion. Request your copy.
412 *Atlas Mineral Prods. Co.

Plates, Stainless Steel.....AL stainless steel plates in solid or clad are produced in the exact grade & surface finish required. The latest information is available in the 32 p. booklet of data on types, sizes, finishes etc.
290 *Allegheny Ludlum Steel Corp.

Plating, Nickel.....New, fully illustrated 16 p. bulletin, "Technical Instructions for the H-VW-M Sulfamate Nickel Plating Process," describing a versatile nickel plating process, is now available on request.
418G Hanson-Van Winkle-Munning.

Steels, Nickel-Plated.....12 p. Technical Manual presents a description of CF&I lectro-clad nickel-plated products covering manufacturing techniques and fabrication procedures. Copies available on request.
418H Colorado Fuel & Iron Corp.

* From advertisement, this issue

These . . .
are the products of

BRILL
EQUIPMENT COMPANY

GEORGE G. RODGERS NEW EQUIPMENT DIVISION

Built to specifications in a complete range of sizes and capacities

- **REACTORS**
- **KETTLES**
  Stainless steel from 20 to 500 gallons
- **CONDENSERS and HEAT EXCHANGERS**
  Stainless steel
- **TANKS**
  Stainless steel
- **TOP ENTERING MIXERS**
  ¼ to 25 hp
- **SIDE ENTERING MIXERS**
  ¼ to 25 hp
- **PORTABLE MIXERS**
  ¼ to 5 hp
- **POWDER MIXERS and BLENDERS**
  Steel and stainless steel
- **POWDER & PASTE FILLERS**
- **BALL and PEBBLE MILLS**
  to 6' dia. x 8' long

FOR OTHER EQUIPMENT SEE OUR ADVERTISEMENT ON PAGE 387 OF THIS ISSUE

George G. Rodgers Division has had years of concentrated experience engineering and manufacturing fine equipment for many of the largest companies in the chemical process industries. We suggest you submit your specifications now, without obligation.

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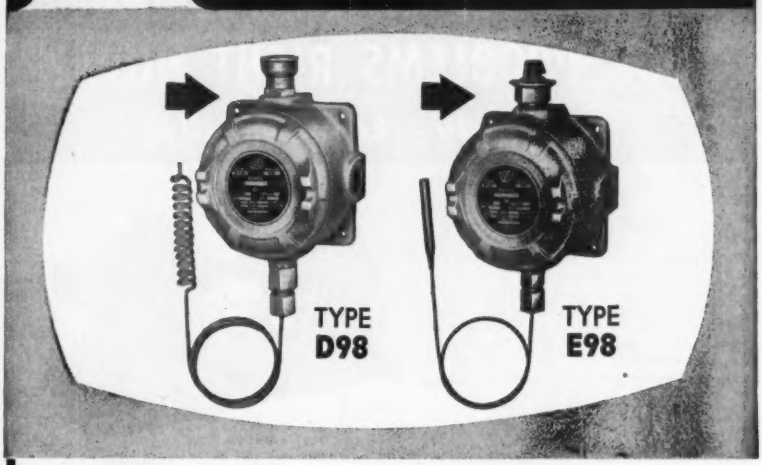
D98 | E98 EXPLOSION PROOF TEMPERATURE CONTROLS



UNITED ELECTRIC has designed the D98 and E98 units to automatically and sensitively control the temperatures of gases, liquids and hot plate applications where explosive vapors and gases are present. Both units feature external, calibrated temperature adjustments. The E98 adjustments are made by a single-turn adjustment knob and pointer, while the D98 has a multiple-turn, micrometer type adjustment.

Temperature Ranges	Type D98 — 300° or 550° F between limits of −150° and +650° F. Type E98 — 100° or 200° F between limits of −150° and +650° F.
Thermal Assemblies	Various shapes and sizes of thermal assemblies available. Completely liquid-filled bellows, bulb and capillary assembly.
Switch Ratings	15 amps. at 115 or 230 volts AC, also 20 amps. or DC switches on specification.
Switch Types	N.O., N.C., or Double Throw, no neutral position.
Electrical Connections	Two, ¾" NPT conduit openings in enclosure. Internally-located terminal block.
Size & Weight	9¼" x 5¾" x 3⅞" — weighs approx. 8 lbs. 4 oz.
Enclosure	Class I, group D and Class II, groups E, F and G explosion-proof enclosures; cast iron base, aluminum cover.
ON-OFF Switch Differential	Fixed, uniform throughout specified range.
Mounting	Surface mounted in any position by mounting holes in each corner of base.

UNITED ELECTRIC *manufactures a complete line of temperature, pressure, and vacuum controls. UE will gladly modify or custom-build a unit to meet your specifications. Consult a UE application engineer today.*

Write for Bulletin No. 3-1 for complete D98 data or Bulletin No. 3-5 for complete E98 data.

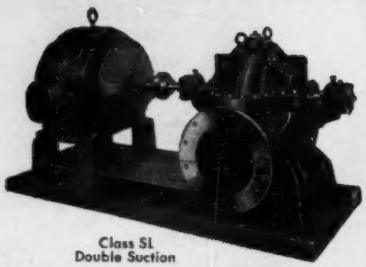
UE *United Electric Controls*
COMPANY
84 SCHOOL STREET, WATERTOWN, MASS

WHICH OF THESE "BUFFALO" PUMPS COULD BE SOLVING YOUR PROBLEMS RIGHT NOW?

(Efficiently — Economically)

CLEAR WATER

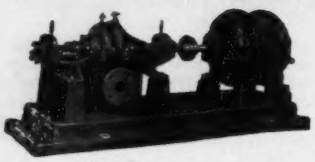
"Buffalo" Double Suction Pumps are the finest example of the "Q" Factor* that gives you the most for your pumping dollars. Hydraulically balanced, highly efficient and durable. In sizes to deliver from 10 to 14,000 gpm for circulating, air conditioning, other plant services. **Request Bulletin 955-Q.**



Class SL
Double Suction

BOILER FEED

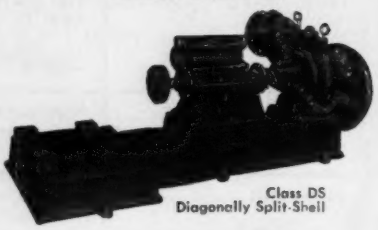
For boiler feed and other clear water service against high pressures, **write for Bulletin 980** and see how efficiently these rugged "Buffalo" Type "RR" Pumps perform. In 2 and 4 stages to handle up to 500 psi. Capacities up to 900 gpm.



Class RR
Multistage Single Suction

PAPER STOCKS

For handling high consistency liquids, you'll save money and trouble with non-clogging "Buffalo" Paper Stock Pumps. Available in alloys or rubber-lined for corrosive and abrasive liquids. A pump for every job described in **Bulletin 953.**



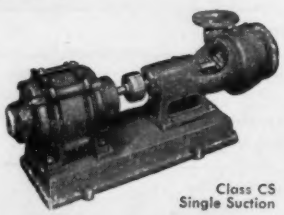
Class DS
Diagonally Split-Shell

CHEMICALS

A complete line of "Buffalo" Pumps, ready to handle corrosive or abrasive liquids at least maintenance cost. Write for **Bulletins 976 and 982.**

OTHER PUMPS

"Buffalo" builds Vertical Ejectors, Sewage Pumps, Fire Pumps, Marine Pumps and the husky, space-saving Close-Coupled Pump shown. In short, there's a "Buffalo" Pump for best results in any application you may have in mind. Write us about **your** probelm!



Class CS
Single Suction

"Buffalo" PUMPS

Class CCL
Close-Coupled
Write for Bulletin 975-D

*** The "Q" Factor —the built-in Quality which provides trouble-free satisfaction and long life.**

"Buffalo" PUMPS

BUFFALO PUMPS

DIVISION OF BUFFALO FORGE COMPANY

501 BROADWAY • BUFFALO, N. Y.

Canada Pumps, Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

LITERATURE . . .

Surfacing, Floor.....Newest advancement in continuous search for better corrosion-proof materials — offers greater protection than conventional acid-proof floor materials. Trial sample of Corocrete on request.
R429 *Ceilcote Co.

Electrical & Mechanical

Belts, V-.....Four reels of Veelos adjustable v-belt replace up to 316 different sizes of endless belts—& take up a space of only 16 in. square. Veelos Data Book contains valuable engineering data.
17 *Manheim Mfg. & Belting Co.

Drives, Adjustable Speed.....New illustrated folder describes the "Ampli-Speed" Magnetic Drive . . . which provides precise, adjustable speed power for a wide range of applications. Bulletin 4400-PRD-229.
420A Electric Machy. Mfg. Co.

Drives, V-Belt.....Issues 74 p. booklet carrying handy multi-color tables for quick & easy selection of constant speed "Texrope" V-belt drives. Also covers design features, basic drive principles, etc. Tex-Book 20P40.
420B Allis-Chalmers Mfg. Co.

Electronic Equipment.....Profusely illustrated product reference contains detailed technical information on Langevin transformers and reactors, broadcast amplifiers, power supplies, special equipment, etc. 8 p.
420C Langevin Mfg. Corp.

Expanders, Tube.....Advantages: uniform & tight pressure joints; no over-rolled or under-rolled tubes; extended tube expander life; more production & higher profits. For more information, request Bulletin 55.
215 *Thomas C. Wilson

Gaskets.....Spirotalic gaskets hold their seal because they are made of spirally wound interlocking plies of asbestos & spring-like metal strip. Gaskets compress easily with light bolting. Catalog PK-35A.
127 *Johns-Manville.

Gasket, Teflon.....The ideal seal for many process applications is a Flexitallic gasket with teflon trapped between edges of stainless steel. For complete data request folder, "Teflon in Flexitallic Gaskets."
298 *Flexitallic Gasket Co.

Motors, Varidrive.....Advanced features accent dependability: microspeed control; quiet, shockless power; simple, economical operation, universal application; long life; etc. Fully illustrated 16 p. Bulletin No. 1797.
420D U. S. Elecl. Motors

Relays, Time Delay.....New illustrated product literature describes the models NEL Agastat and NEH Agastat, two recently developed time delay relays. Operation of each model covered in detail. Bulletin SR-6R.
420E Elastic Stop Nut Corp.

Seals, Mechanical.....For meeting severe sealing conditions. Pressures from 50 psi to 1000 psi . . . temperatures from minus 80°F to 450°F. For data on applications, request Dura Seal Catalog 455-CE.
TL403 *Durametallic Corp.

Switches, Magnetic Limit.....The new Femco Limit Switch provides automatic control for numerous applications. Makes available an illustrated Data Sheet which includes data on installation, types & operation.
420F Femco, Inc.

Teflon Products.....Illustrates various of the many special molded & machined parts firm has fabricated from pure teflon, glass-filled teflon, glass- & carbon-filled teflon & zircon-filled teflon. Bulletin No. CP554.
L333 *Chemical & Power Products.

* From advertisement, this issue

Now turn to the back . . .

Simply circle the code numbers desired on the handy pre-paid postcard, and mail it to us. Replies will reach you direct from the companies manufacturing the products.

Teflon Products.....Illustrated booklet, "The Best in Teflon," covers data on Teflon parts & products—bellows, bellows connectors, pump & valve packings, tubing & other molded forms. 12 p. Chemlon Catalog.
328a *Crane Packing Co.

Transformers, Dry-Type.....For portable tools, machines or lighting systems, these transformers get the right voltage close to the load—give you a flexible, modern power system. For details, request Bulletin TU-57.
92 *Wagner Electric Corp.

Transistors & Rectifiers.....New brochure, designed as a quick reference guide for electronic engineers, contains condensed specification and rating information on transistors and rectifiers. Publication No. ECG-95.
421A General Elec. Co.

Turbines, Steam.....Turbines range from 150 horsepower down to fractional in 6 frame sizes. Feature large number of manually operated valves for individual control of steam nozzles. Details in Bulletin 135.
239 *Coppus Engrg. Corp.

Unit Substations.....Modernize your plant's electrical system with A-C unit substations. Units fit into any plant & can be mounted anywhere. For more information, request your copy of "Power at Load Centers Pays Off."
225 *Allis-Chalmers Mfg. Co.

Wire & Cable, Electrical.....Illustrated, 16 p. lists all trade names, products & their applications. Selection charts help select the best insulated electrical cable for each condition of use. Request Bulletin 1096.
421B Okonite Co.

Handling & Packaging

Belting, Conveyor.....For hauling capacity tonnages of coal, ore, rock & gravel to greater heights . . . over longer distances, use practical, low-cost Super Raynile conveyor belting. Details in Folder No. H-21.
421C Hewitt-Robins.

Belts, Conveyor, Woven Wire.....Presents a 130 p. Reference Manual illustrating and describing company's woven wire conveyor belts. Includes mesh specifications, design information, and metallurgical data.
R437 *Cambridge Wire Cloth Co.

Carloading Practices, Freight.....Offers a Carloading Check Chart for Anchored Loads. Chart includes instructions for preparing car, wrapping anchor plates, draping car, bulkhead construction, use of strapping tools.
421D Signode Steel Strapping Co.

Cars, Freight.....Descriptive booklet tells the story of company's highly-successful new RB-DF all-weather freight car which protects lading from temperature extremes, eliminates bracing and stops damage claims.
421E Evans Products Co.

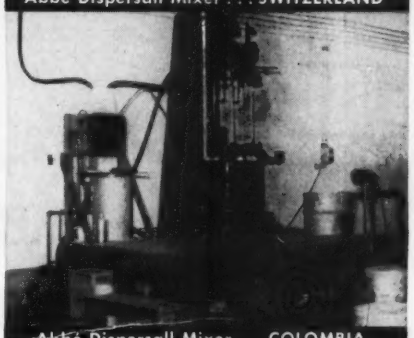
Conveyors.....New portable Ve-Be-Veyor handles heavy loads—fast. The novel "in-the-groove" feature of the new Farquhar conveyor revolutionizes power-driven belt conveyors. Request Bulletin No. 600 for more details.
423 *A. B. Farquhar Div.

* From advertisement, this issue

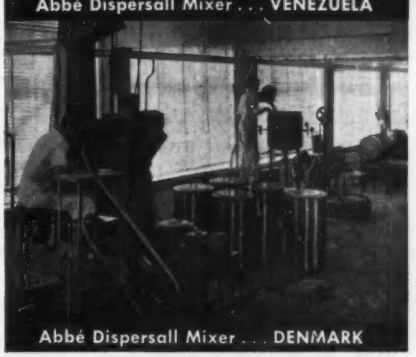
ALL OVER THE WORLD

in the Plants of One Company

Abbé Dispersall Mixer . . . SWITZERLAND


Abbé Dispersall Mixer . . . COLOMBIA

Abbé Dispersall Mixer . . . VENEZUELA


Abbé Dispersall Mixer . . . DENMARK

The pictures shown here are of Abbé Dispersall Mixer installations in a few of the foreign plants of a world-famous manufacturer of cosmetics. There are many more. These mixers are used in the manufacture of tooth and other pastes.

The fact that this company has adopted Abbé Dispersall Mixers for pastes in its foreign plants (as well as in its domestic factories) is ample evidence of the superior performance of these mixers.

Here's What They Say About These

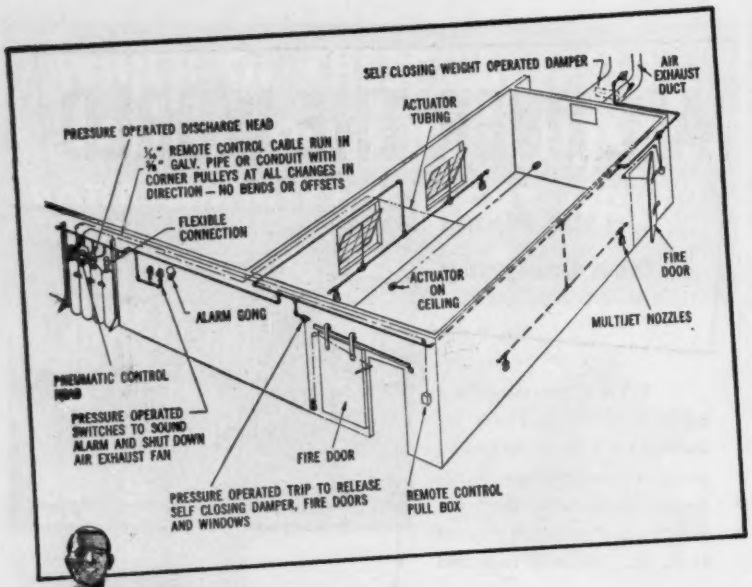
ABBÉ DISPERSALL MIXERS:

"They have met our requirements for a versatile piece of equipment suitable for relatively small scale production. They have the valuable quality of being easy to clean, which, as you can appreciate, is a decided advantage when more than one product is made in the same machine."

If You Are Mixing Liquids or Pastes...

ask us for a recommendation, as well as full details on the advantages of the Abbé Dispersall Mixer.

ABBÉ ENGINEERING COMPANY
50 Church Street • New York 7, N. Y.


SELF CLOSING WEIGHT OPERATED DAMPER
AIR EXHAUST DUCT
ACTUATOR TUBING
PRESSURE OPERATED DISCHARGE HEAD
½" REMOTE CONTROL CABLE RUN IN ¾" GALV. PIPE OR CONDUIT WITH CORNER PULLEYS AT ALL CHANGES IN DIRECTION — NO BENDS OR OFFSETS
FLEXIBLE CONNECTION
ACTUATOR ON CEILING
FIRE DOOR
ALARM GONG
MULTIJET NOZZLES
PNEUMATIC CONTROL HEAD
PRESSURE OPERATED SWITCHES TO SOUND ALARM AND SHUT DOWN AIR EXHAUST FAN
FIRE DOOR
PRESSURE OPERATED TRIP TO RELEASE SELF CLOSING DAMPER, FIRE DOORS AND WINDOWS
REMOTE CONTROL PULL BOX

CHEMICAL STOREROOMS NEED THIS ENGINEERED FIRE PROTECTION!

DANGEROUS hazards in the chemical industry *can* be protected efficiently against fire – *if* you install a Kidde Automatic CO_2 Fire Extinguishing System!

The Kidde system diagrammed above shows how Kidde protection works. Patented Kidde rate-of-temperature-rise actuators trigger the system at the first sign of fire, insure *complete* 24-hour-a-day protection even in case of outside power failure! Kidde multijet nozzles—because of their unique design—distribute carbon dioxide in the most efficient way possible, snuffing out fires cleanly and quickly. And the new Kidde Pneumatic Discharge Head assures an instantaneous and complete discharge of CO_2 gas, also eliminates the need for clumsy mechanical triggering methods.

All moving parts of a Kidde system are completely enclosed for safety, have easy-to-read visual indicators which show at a glance whether system is "set" or "released." What's more, special Direction Valves on the Kidde system let you protect more than one hazard from the same bank of cylinders, a feature that means highly versatile fire protection.

It's easy to get the *best* in fire protection. For more information about *your* specific problems, write Kidde today.

Kidde

Walter Kidde & Company, Inc.
228 Main Street, Belleville 9, N. J.
Walter Kidde & Company of Canada, Ltd.
Montreal—Toronto

The words 'Kidde', 'Lux', 'Lux-O-Matic', 'Fyre-Freez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

LITERATURE . . .

Conveyors, Screw.....Link-Belt's sound engineering and quality manufacture assure you of top performance. A 92-page Screw Conveyor Book contains complete ordering data. Request your copy. Book No. 2289.
14 *Link-Belt Co.

Conveyors, Steel-Belt.....48 p. hard cover book gives extensive engineering & application data. Covers basic features of the conveyor & the steel belt & offers details on characteristics, capacities, design, etc.
422A Sandvik Steel.

Conveyors, Vibrating.....Jeffrey vibrating conveyor propels salt through a drier, drying it to .02% moisture content. Whatever your processing-conveying problem, Jeffrey can handle it Request Catalog No. 860.
270 *Jeffrey Mfg. Co

Feeders, Vibrating.....Covers Velofeeder, a new mechanical vibrating feeder. Outlines operating principles & specifications of feeder, which can be electronically synchronized to match flow-speed of other equipment.
422B Richardson Scale Co.

Feeders, Vibratory.....For complete protection against dusty atmosphere & supply hopper spillage, a new optional dust-tight design feature has been incorporated in the F-55DT feeder. Details, specifications, etc.
422C Syntron Co.

Feeders, Wet Reagent.....Accurately meter minute quantities of liquid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of feeder to bulk storage device. Data in Bulletin F6-B9.
R445e *Denver Equipment Co.

Loading Arms.....Provides descriptive information on the new hydraulically controlled Chiksan Marine Loading Arm . . . the first basic improvement for loading and unloading of petroleum products in over 30 years.
291 *Chiksan Co.

Movers.....Moving heavy equipment is now a quick, safe, & easy in-plant operation with Mighty Movers. Eliminate skids & pipes, cut make-ready time 75%, work easily on rough floors, simple to use, etc. Illustrated, 4 p.
422D Mighty Mover Co.

Packaging.....''Aerosols Unlimited'' traces development of self-spraying package, discusses pros & cons of push-button containers, tells manufacturers how they can evaluate their products for aerosol package, etc.
422E Sprayon Products.

Packaging.....Offers a new, fully illustrated booklet containing information to help you obtain maximum efficiency from corrugated boxes . . . at minimum cost. Request 24 p. "How To Test Corrugated Boxes."
422F Hinde & Dauch.

Plates, Magnetic.....New reference describes features & applications of Homer Permanent Magnetic Plates. Includes application diagrams, performance information & description of complete line. Bulletin PL-250.
422G Homer Mfg. Co.

Scales, Automatic Bagging.....Fully describes the Richardson Model E-50 automatic bagging scale. Includes details of its numerous features, tested design, operation, capacity, etc. Request Bulletin 3749A.
422H Richardson Scale Co.

Scales, Dial.....Features: streamlined, easy to read, easy to use and they have the new, patented Floaxial dial mechanism that assures enduring accuracy. For the complete story on line, request new Bulletin.
84-5 *Fairbanks-Morse & Co.

Trailer-Tanks, Glassed Steel.....New trailer-tank saves time and money with liquid transfer . . . eliminates drying and packaging . . . saves the trouble of returning your product to a liquid upon arrival. Data 29.
454b *Pfaudler Co.

* From advertisement, this issue

Trucks, Industrial Lift.....Illustrated Folder describes new KGA51 series of industrial lift trucks with Yale Torque Transmission. Features: greater driver efficiency; smoother operation; longer truck life; etc. 4 p.
423A Yale & Towne Mfg. Co.

Trucks, Materials Handling.....New L-S HydraFork with extendible forks give you maximum floor protection in minimum (6") aisles. L-S has the only complete line of materials handling trucks on the market. Catalogs.
255 *Lewis-Shepard.

Weight Control.....Through Toledo's electronics system of remote data handling, weight data is no longer limited as to form, or close proximity to the point of origin. Bulletins on new remote digital-indication & recording.
486 *Toledo Scale Co.

Heating & Cooling

Baths, High Temperature.....Leaflet describes the Hy-Temp Aging Bath. Covers uses—including ASTM rubber aging test methods—and the numerous features. Request your copy of illustrated Bulletin No. 668.
423B Precision Scientific Co.

Boilers, Packaged.....Describes the new forced-draft "CB—with the fan mounted inside the front hinged door." Latest Boiler Bulletin covers your size requirements—contains specification data to help you plan.
155 *Cleaver-Brooks Co.

Burners.....With "Surface" Automatic Proportioning, the precise amount of air required for complete combustion is constantly mixed with the gas. For complete information, request Bulletin No. H55-5.
H327 *Surface Combustion Corp.

Combustion Equipment.....Eclipse "process Designed" combustion equipment fires immersion heating tanks for finishing aluminum. Request Catalog describing Eclipse's line of combustion components.
330 *Eclipse Fuel Engrg. Co.

Condensers, Barometric.....Provide an economical means of condensing steam and producing vacuum. Generously illustrated booklet describes two types—Disc-Flow and Ejector-Jet. Request copy of Form No. 9012-A.
423C Ingersoll-Rand Co.

Coolers, Cascade.....Designed for cooling corrosive liquids and gases. Low initial cost and maintenance, radiused returns for low pressure drop as well as redwood waterguide strips. Catalog Section No. S-6820.
219f *National Carbon Co.

Furnaces.....Makes available a new technical bulletin describing furnaces for the heating and heat treatment of aluminum and other light metal alloys from the ingot to the finished product. Bulletin No. SC-171.
423D Surface Combustion Corp.

Keeping too busy?

You'll find our streamlined Reader Service section right up your alley. It's designed for busy engineers who want to find things fast, get more information fast. RS is easy to use, and you can bank on it.

* From advertisement, this issue

New portable **Ve-Be-Veyor** handles heavy loads—*Fast!*

The conveyor with the belt that **Can't Run Off Center**

THE novel **"in-the-groove"** feature of the new Farquhar Ve-Be-Veyor revolutionizes power-driven belt conveyors. For now, at last, your conveyor belt will run true and straight from the time you turn on the power in the morning until the last shift is through at night.

Hour-after-hour, this conveyor will carry boxes, cartons, bags—any packaged materials—into, through and out of your plant, factory or warehouse with less worry or attention than you give the family cat. Easily portable because it's made of aluminum.

HEAVY LOADS, TOO . . . Moreover the new Ve-Be-Veyor is no sissy when it comes to doing the work. Actual performance tests, under hard, practical working conditions prove that it stands up to punishment—often carries loads heavier than the entire weight of the conveyor, including the motor unit.

FIND OUT FOR YOURSELF . . . Send for Bulletin No. 600 which tells in detail all about the NEW Ve-Be-Veyors made by Farquhar. Or better yet, ask us for a demonstration, without obligation, of course.

MAIL THIS COUPON

A. B. FARQUHAR DIVISION, The Oliver Corporation
Conveyor Dept. F-14, York, Penna.
Factory branch: 618 W. Elm St., Chicago 10, Ill.

☐ Send me Bulletin No. 600 about the Farquhar VE-BE-VEYOR.
☐ Please arrange for a demonstration of the new Farquhar VE-BE-VEYOR.

OLIVER Farquhar CONVEYORS

Name
Company
Street
City State

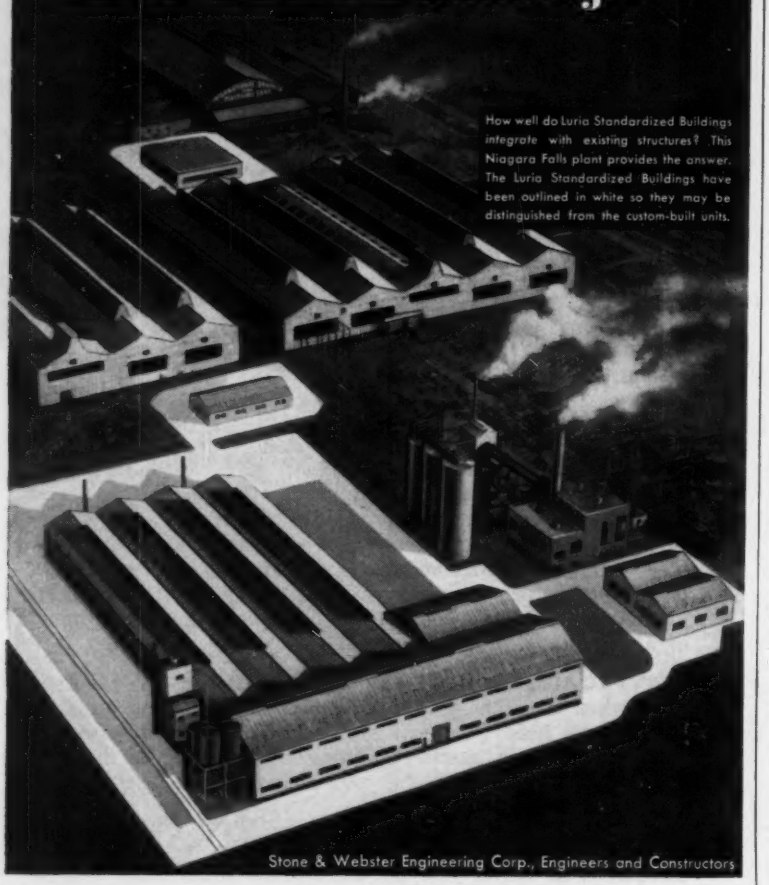
POWER BELT AND GRAVITY CONVEYORS

ANOTHER INDUSTRIAL LEADER...

INTERNATIONAL GRAPHITE & ELECTRODE DIV.
SPEER CARBON COMPANY

chooses

LURIA Standardized Buildings


How well do Luria Standardized Buildings *integrate* with existing structures? This Niagara Falls plant provides the answer. The Luria Standardized Buildings have been outlined in white so they may be distinguished from the custom-built units.
Stone & Webster Engineering Corp., Engineers and Constructors

The LURIA system of STANDARDIZATION lowers your building costs and adds high speed to your expansion program

All the advantages of custom-built units are included in Luria Standardized Buildings. Designed for *durability*, Luria structures surpass the most stringent building code regulations. And Luria's standardized components are *engineered for adaptability*. They combine to successfully meet *individual* architectural needs. If these are the requirements of *your* expansion program, Luria can provide them for you . . . at less than the cost of custom-built units and in far less time.

LURIA ENGINEERING Company
511 FIFTH AVENUE, NEW YORK 17, N. Y.
District Offices: Atlanta • Philadelphia • Boston • Chicago • Washington, D. C. • *Plant:* Bethlehem, Pa.

LITERATURE . . .

Generators & Dryers.....Pipe line purging problems solved by Kemp gas generator & dryer. As a unit they insure a constant supply of gas, & dry & free the gas sufficiently of oil vapors. Request information.
241 *C. M. Kemp Mfg. Co.

Generators, Steam.....Vogt steam generators are available in bent tube types and straight tube forged sectional header types for solid, liquid or gaseous fuels. Request descriptive product Bulletins.
199 *Henry Vogt Mach. Co.

Heat Exchangers.....Impervite gives you all basic designs of impervious graphite heat exchangers. An extensive variety of processing equipment is available from Falls. For more information, request Catalogs.
434a *Falls Industries.

Heat Exchangers.....Whitlock has developed a complete transfer oil heating system in one compact "package." It effectively serves to reduce overall equipment & simplify process design. Literature & prices available.
280 *Whitlock Mfg. Co.

Heat Exchangers.....Catalog describes Camac Heat Exchangers for all plating, pickling and anodizing solutions. Lists all solutions used and proper materials of construction to give satisfactory performance.
424A Carl Buck & Assoc.

Heat Exchangers.....Ross exchangers are pre-engineered, fully standardized & easy to install & maintain. Available in a wide range of designs & sizes. For detailed information, request Bulletins 1.1K5 & 2.1K5.
237 *Ross Heat Exchanger Div.

Heat Exchangers..... Describes how equipment offers: chemical resistance to practically all corrosive fluids; resistance to severe thermal shock; high heat-transfer rates; low maintenance; etc. Catalog S-6740.
219d *National Carbon Co.

Heat Exchangers.....Covers complete line of Karbate brand impervious graphite shell & tube heat exchangers. Engineered for maximum corrosion resistance & minimum maintenance. Catalog Section No. S-6840.
219e *National Carbon Co.

Heat Exchangers.....B&G Exchangers feature: efficient design, special features, precision workmanship, & correct selection & handling of materials. Request B&G catalog showing application range.
63 *Bell & Gossett Co.

Heat Exchangers.....New Bulletin describes a unique finned design of heat exchanger which has been specially developed for recovering waste heat from high temperature gases such as stack gases in furnaces or kilns, etc.
424B Griscom-Russell Co.

Heat Transfer Apparatus.....Illustrated booklet provides valuable data on Young heating and cooling coils, air conditioning units, baseboard convectors, unit heaters, convectors, etc. Request your copy of Catalog 256.
424C Young Radiator Co.

Heaters, Unit.....Grid unit heaters feature trouble-free heating service in the major chemical plants for over 25 years—no maintenance or repairs. Get the full story in booklet, "Corrosion in Unit Heaters."
R399 *D. J. Murray Mfg. Co.

Ovens.....Ross' gas fired oven is being utilized to insure proper solution of entirely new processing problems. Leading manufacturers rely upon recommendations by Ross to achieve the exact curing results. Bulletin S.3.
400 *J. O. Ross Engrg. Corp.

Ovens & Furnaces.....Illustrated booklet describes Blue M electric ovens and furnaces and related equipment. Includes laboratory ovens, utility ovens, portable cooling coil, ultra-temp ovens, etc. Bulletin 5520.
424D Ace Glass.

*From advertisement, this issue

Ovens, Industrial.....Your oven needs . . . large or small batch or continuous production for drying, baking or dehydrating . . . can be filled by Kirk & Blum. For details, request Booklet, "Industrial Ovens."
313 *Kirk & Blum Mfg. Co.

Towers, Cooling.....Pritchard Cooling Tower framework is a big step in cooling tower design. "Answers to the 15 Questions About Pritchard Induced Draft Cooling Towers" offers valuable tips.
320-1 *J. F. Pritchard & Co.

Towers, Cooling.....FW cooling towers are built of decay-resistant California redwood. The induced-draft counterflow tower represents an important advance in cooling tower design. Request detailed information.
137 *Foster Wheeler Corp.

Towers, Cooling.....New 20 p. booklet, "Test Your Tower," describes simple direct method by which purchaser of industrial cooling tower can assure himself that he will receive performance exactly as specified.
9 *Marley Co.

Traps, Steam.....Company's product line features long trap life with infrequent maintenance. Makes available on request a 44 p. Steam Trap Book with practical information designed to give you better trapping.
272-3 *Armstrong Mach. Wks.

Traps, Steam.....Impulse steam traps offer valuable features: get equipment hot in a hurry—& keep it hot; good for all pressures without change of valve or seat; easy installation; etc. Request Trap Bulletin.
25 *Yarnall-Waring Co.

Traps, Steam.....Float Thermostatic steam traps keep heating surfaces at top efficiency by discharging condensate practically at steam temperature, continuously and without shock. Data contained in Bulletin No. 450.
425A Sarco Co.

Traps, Steam.....Makes available "Piping Diagram and Steam Trap Selector" which contains Yarway Impulse Steam Trap recommendations for typical chemical processing equipment. Request illustrated Ref. No. T-9 (55).
425B Yarnall-Waring Co.

Instruments & Controls

Accelerators, Electron.....Illustrated, 36 p. covers technical & economic factors that must be considered in applying electron-beam radiation to industrial processing, & describes line of electron accelerators. Bulletin E.
425C High Voltage Engrg. Corp.

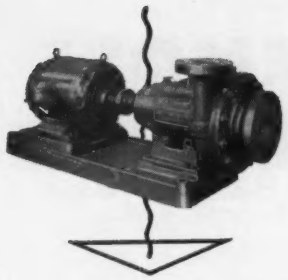
Actuators, Valve.....Makes remote electrical operation of the final control element a reality for the first time. For information on how "EHVA" control is adapted, request Bulletin 200.
312 *Askania Regulator Co.

Computers.....Information and prices are available on the line of Bendix G-15A computers. Features: faster, larger in computing capacity, smaller in size, lowest in cost and they are available now.
103 *Bendix Aviation Corp.

Controllers.....Taylor makes available a data sheet discussing the separation of components in a batch distillation column in the shortest time at the lowest possible cost. Also other recommendations. Data Sheet 11.
276 *Taylor Instrument Cos.

Controllers, Pneumatic.....Illustrated, 4 p. covers P-4 pneumatic controllers: available modes of control; specifications for controller response adjustments; performance specifications; etc. Pub. No. 11517.
425D Fischer & Porter Co.

*From advertisement, this issue



How to make a molehill out of a spare parts mountain

Spare parts for plant machinery are a necessary evil. Nobody loves them—but no plant can afford to be without them. And when it comes to *pumps*, your stock of repair parts can be pretty mountainous—and mighty costly.

But not with Dean Brothers standard centrifugal pumps! Here's why: a single basic cradle assembly serves for an entire series of pumps covering a wide range of applications. Only the Casing, Impeller and Suction Nozzle vary in size with the capacity of each individual pump. All other parts are the same. Obviously, such interchangeability cuts spare parts to an almost unbelievable minimum.

Think what this interchangeability means to you—particularly with a multiple pump installation. Your spare parts mountain becomes a molehill. Fewer parts mean less investment . . . require less storage space . . . take less time to handle and keep inventory records.

This interchangeability is but one of many features which make Dean Brothers standard centrifugal pumps* the best in the long run. For full information, send for Circular No. 184B.

*Series 10, Series 20 and Series 30—to 7,000 gallons per minute capacity.

HERE'S HOW IT WORKS

The eleven pumps in Series C-10 will pump anywhere from 10 gallons per minute up to 700. Total dynamic head can be as little as 25 ft. or as much as 400 ft. Pumping temperatures can be as low as 250° F. below zero or as high as 350° above. Think of it! Eleven pumps covering a range of conditions like this assembled from the same parts with variations in only three parts—all without sacrificing mechanical reliability. But that's only half of it. There's a companion series for high temperature services—Series R-10. The only difference between the two series is that the cradle housing in Series R-10 is integrally water jacketed. All other parts are the same. One shaft fits all 22 pumps. Likewise one shaft sleeve and one set of packing. The bearings are the same—and so on throughout both series.

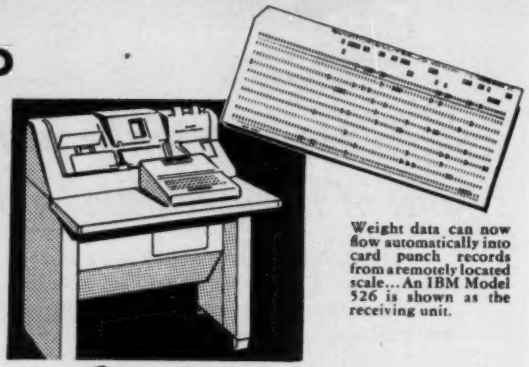
DEAN BROTHERS PUMPS INC.

INDIANAPOLIS 7, INDIANA

Centrifugal and Reciprocating Pumps · Since 1869

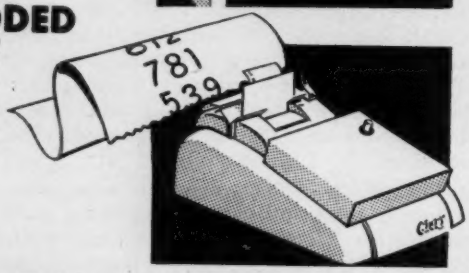
New REMOTE WEIGHT RECORDS

TABULATED



Weight data can now flow automatically into card punch records from a remotely located scale... An IBM Model 526 is shown as the receiving unit.

ADDED

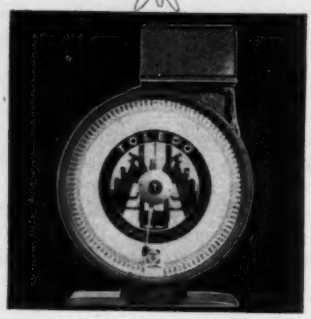


Weight records can be transmitted to an adding machine and printed on the tape and inserted tickets with ability to totalize weight on the tape. Clary Model 1972 shown.

DIGITAL INDICATION

A completely new concept of weight indication! From a remotely located scale, illuminated digital weight-indication is obtained.

by TOLEDO ELECTRONIC WEIGHT CONTROL



The weight indication passes through a Toledo digital scanner and electronic counter and translator to provide an accurate signal that operates these remote devices to bring weights anywhere in the form most useful to you.

Through Toledo's new electronics system of remote data handling, weight data is no longer limited as to form, or close proximity to the point of origin. Weights can now go anywhere . . . and appear in tabulated, added, recorded, or digital-indicated form. This greatly extends the capabilities of TOLEDO-mation throughout production, and assures maximum cost control accuracy.

What is your weight control problem? Write for bulletins on new Toledo remote digital-indication and recording.

Toledo Scale Co., Toledo 1, Ohio.

TOLEDO® *Headquarters for* **SCALES**

LITERATURE . . .

Now turn to the back . . .

Simply circle the code numbers desired on the handy pre-paid postcard, and mail it to us. Replies will reach you direct from the companies manufacturing the products.

Controls, Temperature.....United Electric designs units to automatically control temperatures of gases, liquids etc. where there are explosive vapors Request Bulletin No. 8-1 for the D9 & Bulletin No. 3-5 for the E98.
R419 *United Electric Controls Co

Controls, Valve.....Time, labor & money can be saved by opening & closing valves with LimiTorque . . . "just press the button." There's a type & size of LimiTorque for every valve operating need. Catalog L-550.
13 *Philadelphia Gear Works

Detectors, Temperature.....Illustrated 24 p. covers the complete line of 889(Series Rayotube (heat-radiation) Detectors . . . for continuous temperature measurement to 5000 F and beyond Request Catalog EN-S3.
426A Leeds & Northrup Co

Gages.....With proper application, the new Supergauge will last a lifetime Supergauges are available in 4½" and 8½" sizes. For information on case styles, materials of construction, etc. request Publication 1819.
R443 *U. S. Gauge Div

Gages.....For pressure, vacuum or compound service. There are no gears or teeth to wear out. Cam wiping action keeps contact points clean & smooth Provides complete information in Gage Catalog No. G-2.
215 *Helicoid Gage Div

Gages, Liquid Level.....Completely illustrated 76 p. reference describes the entire line of Penberthy liquid level and water gages . . . and also indicates their numerous points of superiority. Request Catalog 35.
90 *Penberthy Injector Co

Indicators, Sight Flow.....Literature describes the new line of sight flow indicators . . . easily and inexpensively installed in any new or existing pipe line ⅛" to 2" N.P.T. Request detailed Data Unit.
R405 *Jerguson Gage & Valve Co

Instrumentation.....Dynalog instruments can be used with resistance, voltage, capacity, or inductive type primary elements to measure &/or control any process variable with speed accuracy. Bulletin No. 427.
49 *Foxboro Co.

Integrator Systems, Multiple Flow.....Illustrated reference describes company's automatic multiple flow integrator systems. Includes data on the numerous features. Request Catalog 58-30 (Pub. 11520).
426B Fischer & Porter Co

Measurement, Temperature.....The Alnor Pyrocon combines laboratory precision with production tool ruggedness to give you fast, accurate answers to all surface temperature problems. Request Bulletin.
L427 *Illinois Testing Labs

Meters.....Has meters available to handle more than 150 industrial liquids. Neptune water meters reduce the costs of pumping, purifying, softening & distributing water. For complete details, request Bulletin No 566X.
428 *Neptune Meter Co

Meters, Flow.....Feature simple design with only three moving parts—no breakdown due to complicated gears and mechanism. Indicate flow within 3% absolute accuracy, even with pulsating flow. Detailed Bulletin.
TL409 *Henszey Co

*From advertisement, this issue

get this free illustrated bulletin

How You Can Save Time Measuring Surface Temperatures in Your Plant with

ALNOR PYROCONS

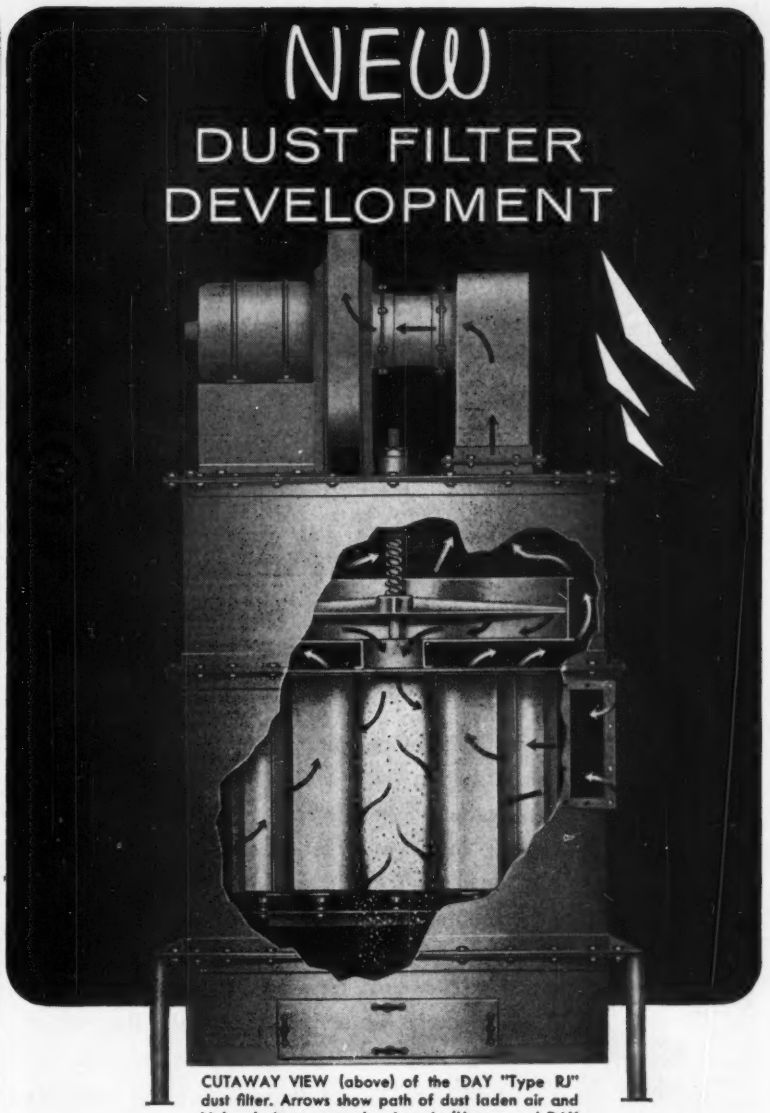
The Alnor Pyrocon combines laboratory precision with production tool ruggedness to give you fast, accurate answers to *all* surface temperature problems. It takes just 3 seconds to give you the temperature of any surface . . . regardless of shape or material. . . revolving or stationary. And the heavy, shock-resisting movement is housed in a balanced unit that's compact, easy to handle.

Mail this ad with your business letterhead to Illinois Testing Laboratories, Inc., Room 559, 420 N. LaSalle St., Chicago 10, Ill.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

NEW DUST FILTER DEVELOPMENT



CUTAWAY VIEW (above) of the DAY "Type RJ" dust filter. Arrows show path of dust laden air and high velocity reverse cleaning air. (Hersey and DAY patents applied for.)

DAY "Type RJ" Dust Filter—First and Only Dust Filter to Offer All These Advantages

- An economical, high efficiency, automatic-continuous dust filter.
- Incorporates Hersey principle of high velocity reverse air for filter sleeve cleaning in a low cost unit.
- Provides efficiencies as high as 99.99+%.
- Automatic—continuous operation makes filter ideal for controlling dust created by continuous process equipment.
- Economical operation—utilizes ½ HP motor for filter sleeve cleaning.
- High air handling capacity for small space occupied by filter.
- Can be furnished for pressure or vacuum operation.
- Shipped completely assembled. Only piping and electrical connections required for operation.

The DAY "Type RJ" dust filter has many advantages to offer your plant. Get the complete facts, write toDAY for Bulletin 560.

75 YEARS SERVING INDUSTRY SINCE 1881 DAY

The DAY Company

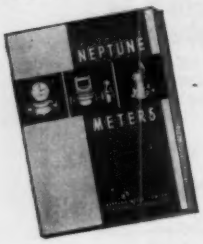
856 Third Avenue N. E., Minneapolis, Minn.
IN CANADA: P. O. Box 70N, Ft. William, Ontario
Branch Plants: Buffalo, Ft. Worth, Toronto, Ontario
Representatives in principal cities

WATER *costs* MONEY

Here's a Simple Way to *Reduce* the Cost

The costs of pumping, purifying, softening and distributing water are something to reckon with. Whether you buy from your local utility or pump your own, your plant water supply probably costs more than it should. Hoses left running, cooling water running down the drain instead of recirculating, neglected leaks, etc., quickly add up to large losses. What's worse, they deplete scarce water resources. Even the cost of sewage disposal depends upon *water* used.

Send for free technical Bulletin 566 X



Best way to cut these costs? Put Neptune water meters at every key point. Get water out of overhead and charge it fairly and squarely against each department or process. What stronger incentive to fix faulty equipment and stop careless habits?

Other Neptune meters also available for handling more than 150 industrial liquids. Ask today for full details . . . or a complete plant survey at no obligation.

NEPTUNE METER COMPANY
19 West 50th Street, New York 20, N. Y.

Branches in:
ATLANTA • BOSTON • CHICAGO • DALLAS • DENVER
NO. KANSAS CITY, MO. • LOS ANGELES • LOUISVILLE
PORTLAND, ORE. • SAN FRANCISCO

In Canada: **NEPTUNE METERS LTD., TORONTO 14, ONTARIO**

neptune liquid METERS

LITERATURE . . .

Meters, Flow.....Brown flow meters assure you the utmost in measurement, integration, control and service, etc. "Flow Meters, Indicating, Recording, Integrating, Controlling." Catalog 2321.
64-5 *Minneapolis-Honeywell.

Meters, Flow.....Measure rate of flow of almost any material that can be pumped thru a pipe—with no obstructions or moving parts of any kind within the pipe system. Data in Catalog 10-C-30 (Pub. 11515).
428A Fischer & Porter Co.

Meters, Positive Displacement.....For measuring gas from 5,000 cfh to a million, you can trust the qualities of R-C Positive Displacement meters. R-C "plur-ability" pays dividends. Details in Bulletin No. M-152.
406 *Roots-Connersville Blower.

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31 *Rockwell Mfg. Co.

Potentiometers, Null-Balance.....From simplest indicator to most complete standard controller—every Speedomax H combines compactness with "big instrument" performance. Details of features in Die-Out ND46(1).
62 *Leeds & Northrup Co.

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156 *Bailey Meter Co.

Regulators, Temperature.....Automatic regulators are self-contained & operated by liquid expansion—no outside power is needed. For temperature ranges between 0° & 300°F, pressures to 175 psi. Bulletin 600.
428B Sarco Co.

Spectrophotometer Flow Charts..... Depict accessories used with DU spectrophotometers. Includes attachments, sample compartments, thermospacers & common spare parts arranged to show their interrelationships.
428C Will Corp.

Telescopes, Industrial.....A.C.M.I. Borescopes permit close-up visual examination of interior areas & surfaces not otherwise visible. They save time & money & prevent costly dismantling. Request Booklet.
BL405 *American Cystoscope Makers.

Thermocouples.....T-E's new "Ceramo" thermocouples will be used to check reactor temperatures on atomic sub "Seawolf." More information on these new metal-clad, ceramic-insulated thermocouples in Bulletin 31-300-E.
432 *Thermo Electric Co.

Transmitters, Pneumatic Pressure..... The Series 1250 Ashcroft pneumatic pressure transmitter is available with pressure sensing elements in all standard pressure ranges & Bourdon tube materials. Bulletin 340.
78 *Manning, Maxwell & Moore.

Viscometers.....The new eight-speed Brookfield viscometer measures viscosity of any fluid. A complete line of accessories makes the Brookfield adaptable to any viscosity measurement problem. Request complete information.
417 *Brookfield Engrg. Labs.

Pipe, Fittings & Valves

Couplings.....Kamlok's positive seal all along the line assures greater safety in handling all types of liquids. Valuable reference highlights in detail Kamlock's quick, tight seal. Bulletin No. F-10.
34 *OPW Corp.

*From advertisement, this issue

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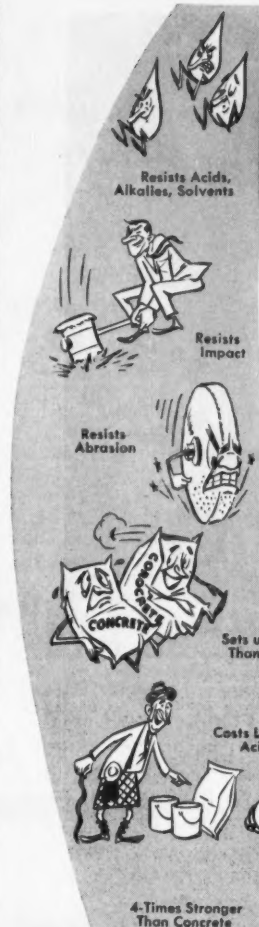

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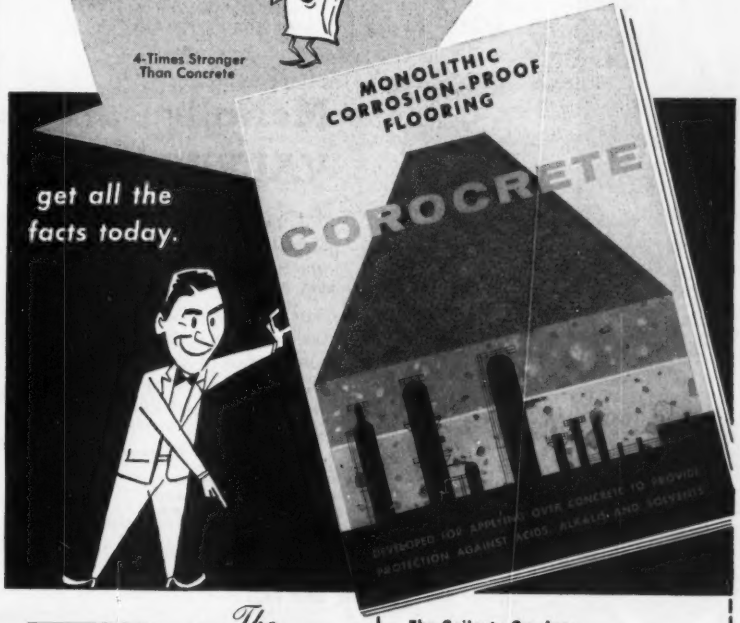

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R329 *Lovejoy Flexible Coupling Co.

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141 *Midwest Piping Co.

Fittings.....Offers Klinger Master Catalog describing the complete range of products . . . compressed asbestos sheet packings for all purposes, valves, cocks, level gages, synthetic and silicone rubbers, etc.
211a *Klinger Corp. of America.

Fittings, Seamless Welding.....B&W fittings are manufactured from seamless steel tubing & are available in alloy, carbon & stainless grades in a wide range of sizes. Grades & size ranges in Bulletin FB-500.
430A Babcock & Wilcox Co.

Fittings, Stainless Steel.....Speedline fittings simplify pipeline design. Details of the greater design flexibility possible with Speedline fittings . . . at lower cost . . . in new fully illustrated catalog.
TL443 *Horace T. Potts Co.

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324 *U. S. Gasket Co.

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448 *Barco Mfg. Co.

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R403 *Monarch Mfg. Wks.

Nozzles, Spray.....Company provides a 48 p. industrial catalog with full data on thousands of standard and special nozzles—for every type of spraying. Also information on related equipment. Catalog No. 24.
TR327 *Spraying Systems Co.

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219b *National Carbon Co.

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82 *Pa. Flexible Metallic Tubing.

Tubing, Stainless Steel.....Furnishes engineering information on constructions and types of flexible stainless steel tubing. Also includes data on fittings. Request this completely illustrated Bulletin No. STC-1.
53 *American Brass Co.

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Unions & Fittings.....Describes a broad line of adapter unions, pipe fittings and boss and bulkhead adapter unions. Reference is very complete with dimensional diagrams, and engineering aids. Catalog No. 200.
431A Anchor Coupling Co.

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TL899 *Clayton Mark & Co.

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436a *McNally Pittsburg Mfg. Corp.

Valves.....Tube Line valves up to 4000 psi eliminate pipe threading . . . seal welding . . . & every joint is a union. Easy & fast assembly in lines win preference for valves in many industries. Bulletin No. 255.
86 *Autoclave Engrs.

Valves, Ball.....Jamesbury double-seal ball valves offer valuable advantages: leak proof performance, full flow and quarter turn operation, minimum maintenance. etc. Illustrated booklet gives complete details.
431B Jamesbury Corp.

Valves, Ball.....Made of bronze, the new Rockwood Top Entry Ball Valve is ideal for handling oxygen & hazardous liquids as well as water, oil & gas. Illustrated Brochure covers valve features & specifications.
431C Rockwood Sprinkler Co.

Valves, Check.....Fast, quiet operation means low cost operation for check valves . . . and that's exactly what the Chapman Tilting Disc Check Valve is designed to do. Data on full line in Catalog No. 30-A.
18 *Chapman Valve Mfg. Co.

Valves, Control.....For fluid control—the new Foster control valve with Isoforce actuator . . . gives you more power when you need it. Available in sizes starting at ½". Details in Bulletin CV-1.
444 *Foster Engrg. Co.

Valves, Diaphragm.....Describes Grinnel-Saunders diaphragm valve with straight-through flow. Includes advantages, maintenance, design, selection of bodies and bonnets, etc. Fully illustrated, 4 p.
16 *Grinnell Co.

Valves, Drain.....Offers descriptive information on line of Strahman ram type valves . . . the only drain valves that cannot clog up. Made in any cast metal to meet your requirements. Request complete Catalog.
BL325 *Strahman Valves.

Valves, Gate.....G-A flowtrol valves are built to last a lifetime. Use the angle body and save the price of an elbow fitting. They operate with finger pressure. For more information, request Bulletin W-8A.
R331 *Golden-Anderson

Valves, Gate.....Darling gate valves are made in metals, types and sizes for most services . . . and for pressures up to 1500 pounds. Feature fully revolving double disc parallel seat principle. Bulletin No. 5003.
402 *Darling Valve & Mfg. Co.

Valves, Hydromatic.....These valves assure easy, accurate control of ion exchange equipment. They are so constructed that it is impossible for them to be out of position during operation. Bulletin 4520-B.
354 *Cochrane Corp.

Valves, Iron.....Reduce valve wear. Choose from 29 OIC iron valve numbers with 9 different trim & body metal variations. This line's many added features are described in the new OIC Folder No. 1005.
67 *Ohio Injector Co.

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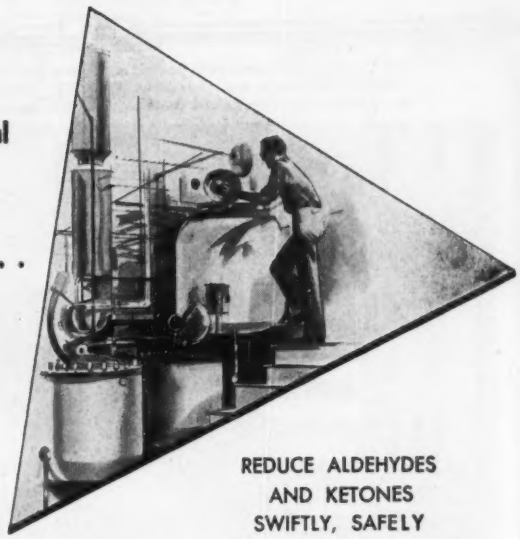

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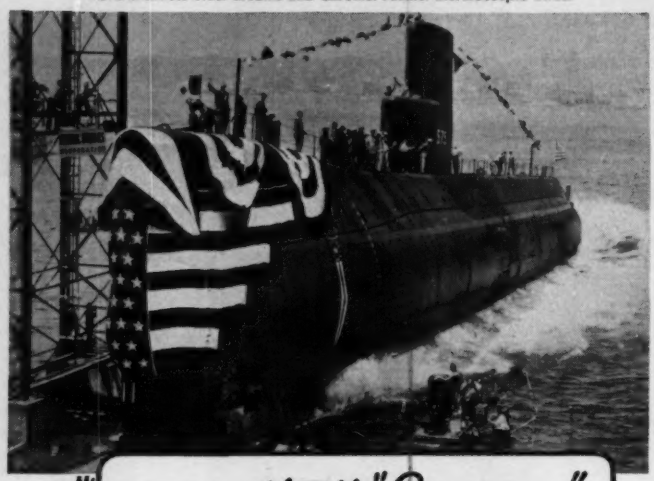

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LITERATURE . . .

Valves, Lubricated Plug.....28 p. catalog shows straightway, 3-way, 4-way, & multiple port lubricated plug valves for 250 lbs. oil-water-gas & 150 lbs. steam working pressure. Reference Book 39—5.
158 *Homestead Valve Mfg. Co.

Valves, Plug.....For special services—handling products that will harden or congeal at ordinary temperatures—Wedgeplug Valves can be supplied steam-jacketed. Offers full details in Wedgeplug Catalog 55-1-W.
275 *Wedgeplug Valve Co.

Valves, Needle.....The Marsh needle valve is now available in 416 stainless steel throughout. It is guaranteed for working pressure up to 10,000 psi. For complete details, request bulletin No. NV-2.
TL323 *Marsh Instrument Co.

Valves, Relief.....Aminco relief valves, with Stellite stems & seats, are available in three pressure ranges: 500-7500, 1000-15,000, & 5000-45,000 p.s.i. Dimensions: 3¼ in. diameter; 15¼ in. long. Superpressure Catalog 406-C.
BL409 *American Instrument Co.

Valves, Segregating Slide.....Covers company's line of slide gate type of segregating valves for pneumatic materials handling systems. Includes data on application, design, operation, etc. Data Sheet Ua.
432A Allen-Sherman-Hoff Co.

Valves, Solenoid.....ASCO is one source that solves virtually any solenoid valve problem. Has available more than 1300 types of valves. For more complete information, request Catalog No. 24.
81 *Automatic Switch Co.

Process Equipment

Absorbers.....For absorption of hydrogen chloride and other gases. Produce as much as 20 tons per day 22° Baume acid. Pneumatic automatic control. Complete information in Catalog Section No. S-7460.
219C *National Carbon Co.

Centrifugals.....When your process calls for liquid-solids separation by centrifugal force . . . you can do it more economically with the new Tolhurst Center-Slug centrifugal. Request descriptive Catalog.
414 *American Mach. & Metals.

Centrifuges.....The Sharples DH-3 Nozlector is the centrifuge for your plant. It puts more horsepower, & all the horsepower where it belongs—into the centrifuge bowl. For details, request Bulletin No. 1276.
131 *Sharples Corp.

Clarifiers & Thickeners.....Questions on design requirements of clarifiers & thickeners for a wide range of capacities & solids removal loads are answered in 16 p. illustrated book. Bulletin No. W-800B-S-6000B.
432B Infilco, Inc.

Classifiers.....All classifiers (Rake Type, Spiral, Hydro) are designed to efficiently separate fine particles in specific applications. For complete information on company's line, request Bulletin C5C-B.
R445c *Denver Equipment Co.

Crushers, Jaw.....Cast steel frame, manganese jaw & cheek plates. Large diameter shafts reduce shaft deflection & thus increase life of heavy-duty, oversize roller bearings in bumper. Bulletin No. C12-B12.
R445d *Denver Equipment Co.

Cylinders, Gas.....Hackney seamless or two-piece cylinders are made in all sizes . . . for all compressed gases. Cylinders are designed with low tare weight for easy handling & shipping. Complete details upon request.
15 *Pressed Steel Tank Co.

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Cylinders, Gas.....Safety & long life are prime considerations in the design of Harrisburg high pressure gas cylinders. Yet they are as light as sound engineering permits. For details, request literature.
TL329 *Harrisburg Steel Corp.

Dehydrators.....Selas Dehydrator continuously dries compressed air, carbon monoxide, carbon dioxide, hydrogen, oxygen, gaseous hydrocarbons and inert gases. Contains full information in Bulletin No. 112.
274 *Selas Corp. of America.

Disintegrators.....Illustrated reference describes Rietz Disintegrators for the chemical process industries. Includes a cut-away view of a Rietz Disintegrator model, features, specifications, etc. Bulletin 501.
433A Rietz Mfg. Co.

Dryers.....Available in several types: direct heat, indirect heat, and steam tube. Let Deco engineers help solve your drying problem—no dryer problem too small or too large. Details in Bulletin No. D4-B2.
R445j *Denver Equipment Co.

Dryers, Air.....The advantages and practical features of closed circuit drying using an inert gas for removal and recovery of an organic solvent are covered in a 4 p. illustrated reprint now available.
433B Wyssmont Co.

Dryers, Rotary.....Deliver top production, exacting performance, greater profits. Tells how Standard-Hersey has aided manufacturers throughout the world in solving their dryer problems in illustrated Catalog.
TL405 *Standard Steel Corp.

Dryers, Rotary Vacuum.....Company announces the availability of literature on their vacuum drying equipment (Catalog No. 720) and a new reference covering Stokes Laboratory facilities (Bulletin No. 640).
52 *F. J. Stokes Mach. Co.

Dryers, Steam Tube.....Ruggles-Coles steam tube dryers have been supplied fabrication of alloys to provide protection against corrosion & contamination. All fabrication is to code requirements. Request Bulletin No. 16-D-11.
441 *Hardinge Co.

Dryers, Vacuum.....Faster, uniform heat transfer, plus rapid vapor removal . . . means today's best in vacuum drying with the Patterson Conaform. For complete product data, request new detailed Bulletin.
308-9a *Patterson Foundry & Mach.

Dust Collectors.....In almost every type of industry . . . users have found high efficiency, simplicity & economy of Dustube collectors a difficult combination to equal for top performance. Bulletin No. 372C.
98 *Wheelabrator Corp.

Dust Collectors.....New booklet, "The Collection and Recovery of Industrial Dusts" is available upon request. It describes the "SF" electric precipitators and how they meet all 5 basic requirements for top efficiency.
142 *Buell Engrg. Co.

Dust Collectors.....Descriptive and illustrated product literature on the Hydro-static Precipitator . . . a wet-type collector designed for handling heavy duty loadings of all sizes. Bulletin No. 277.
74 *American Air Filter Co.

Dust Control.....Pangborn engineers help solve your dust problems—line of wet or dry dust collectors can save time, trouble & money. See how varied industries are benefited in "Out of the Realm of Dust."
306 *Pangborn Corp.

Dust Filters.....'Type RJ" dust filter is an economical, high efficiency, automatic-continuous dust filter which can be furnished for pressure or vacuum operation. For more complete information, request Bulletin 560.
R427 *Day Co.

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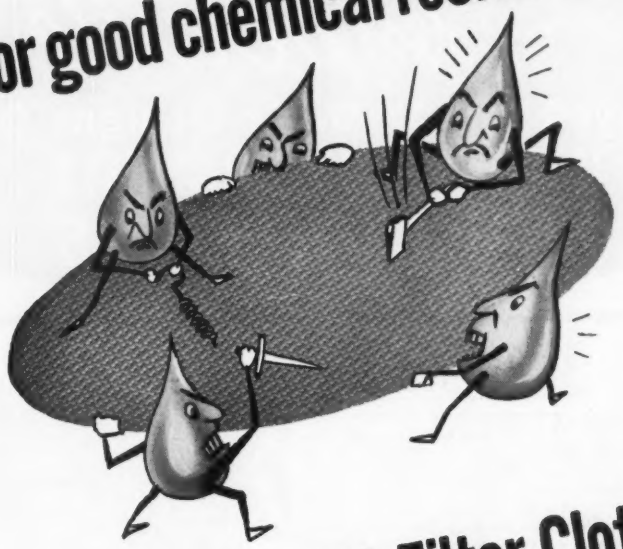

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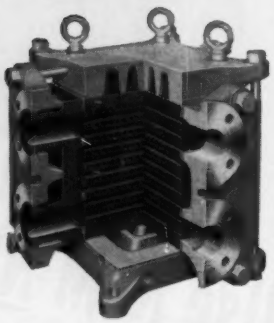

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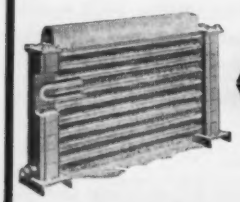

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LITERATURE . . .

Ejectors, Steam-Jet.....Presents a 60 p. "Steam-Jet Ejector Application Handbook" for selection of single and two-stage stock ejectors for general vacuum service. Photos, tables, graphs, etc. Bulletin W-205-E21.
434A Worthington Corp.

Evaporators.....Complete Swenson Catalogue contains full information on long-tube vertical evaporator, spray dryers, crystallizers, forced circulation evaporators & recovery equipment for pulp mills.
6-7a *Swenson Evaporator Co.

Filters.....Cuno's new Super Auto-Klean filter now makes possible economical, compact, micronic filtration at high flow rates & eliminates the need for replacement cartridges. Full data is available upon request.
264-5 *Cuno Engrg. Co.

Filters.....Improved design gives high production at low cost for existing process. Jacketed construction permits heating or cooling where accurate temperature control is required. Details in Bulletin No. 431.
95 *R. P. Adams Co.

Filters.....New built-to-order vertical filters solve complex problems & are easily adapted for special uses. For details on flow systems, special equipment, filter & leaf construction, request Bulletin No. 111.
447 *Industrial Filter & Pump.

Filters, Disc.....Special, patented design of segments in filters use both gravity & vacuum to give a drier filter cake. Drainage is complete & positive with no blow-back. Details contained in Bulletin F9-B2.
R445f *Denver Equipment Co.

Filters, Pressure Leaf.....For flow rates two to five times greater than cloth covered presses; positive removal of all suspended solids to desired degree of clarity; etc. Find details in Catalog No. NC-1-53.
415 *Niagara Filters Div.

Homogenizers, Industrial.....Profusely illustrated folder describes the Gaulin Homogenizer. Includes: construction and operation; theory of homogenization; products processed; specifications; etc. Bulletin H-55.
434B Manton-Gaulin Mfg.

Impactors.....Offer lowest possible cost-per-ton in producing top quality materials from 2" down to 35 mesh with a minimum of fines—or much smaller where more friable products are handled. Detailed literature.
47a *Williams Patent Crusher.

Kilns, Rotary.....Efficient thermo-processing of products. Used in the production of lime, bauxite, cement, sodium silicate, alumina, etc. Complete data on design features offered in illustrated Bulletin 115.
26a *Traylor Engrg. & Mfg. Co.

Mills, Ball.....A steel-head ball mill will suit your particuar need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Bulletin No. B2-B13.
R445b *Denver Equipment Co.

Mills, Imp.....The Raymond imp mill is equipped to handle almost any combination of pulverizing, blending, classifying, conveying and/or drying operation. For more complete details, request Catalog No. 77.
300 *Raymond Div.

Mixers.....Describes Super Agitators & Mixers. Patented standpipe around propeller shaft assures positive agitation & circulation. Patented wearing plate prevents sand-up on shut-down. Bulletin No. A2-B4.
R445a *Denver Equipment Co.

Mixers.....Describes the Day Imperial Mixer. Built for heavy duty, engineered for precision, it incorporates many advanced engineering features to assure you high production at low cost. Bulletin No. 690.
322 *J. H. Day Co.

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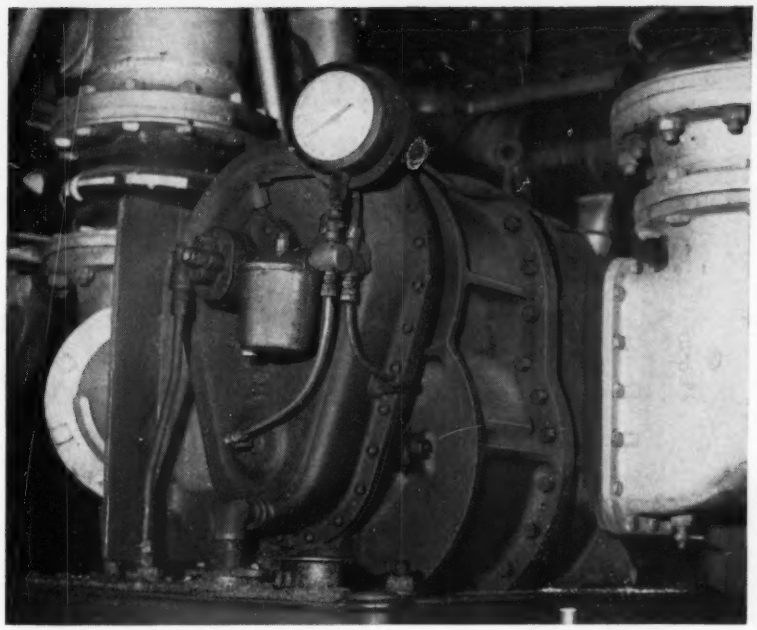

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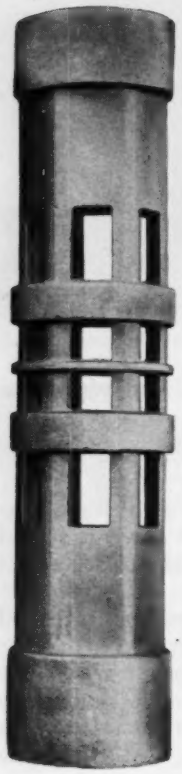

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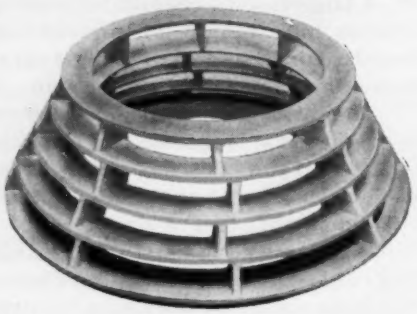

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LITERATURE . . .

Mixers.....Mix-Mullers for chemical and process industries. Covers Simpson mulling principle; mulling for dry, wetted and plastic mixtures; Mix-Mullers for special requirements; etc. 12 p. Bulletin No. 522.
263 *National Engrg. Co.

Mixers.....Company makes available Confidential Mixing Data Sheet. Helpful checklist enables you to develop a complete technical description of agitation required for your process, quickly & easily. No. B-107.
197a *Mixing Equipment Co.

Mixers, Portable.....Use in industry reduces costs, saves time, labor and secures better and more refined products. Catalog includes data on construction, dimensions, specifications, etc. 28 p. No. B-108.
197b *Mixing Equipment Co.

Mixers, Side Entering.....Furnishes detailed information on features, typical applications, mechanical design, maintenance, shaft seals, methods of installation, etc., in completely illustrated Catalog B-104.
197c *Mixing Equipment Co.

Mixers, Top Entering.....Illustrated and detailed 32 p. Catalog includes advantages, typical installations, mechanical description, construction information, dimensions and selection tables, etc. Catalog No. B-102.
197d *Mixing Equipment Co.

Mixers, Top Entering.....Makes available pertinent information on top-entering mixers (propeller type) . . . for closed tanks, pressure & vacuum . . . for open & loose-covered tanks. Data in Catalog No. B-103.
197e *Mixing Equipment Co.

Pelleters, Continuous.....Produce top-quality pellets in tremendous volume at reasonable investment & low operating cost. Large & small pellets—even 1" cubes—in many shapes & sizes. Complete details.
203 *Sprout-Waldron & Co.

Press, Dewatering.....The 1B continuous de-watering press was designed to withstand the heavy service required in the pulp & paper field. It can also be adapted to other fibrous products. Request Catalog A.
BL323a *Davenport Mach. & Foundry Co.

Presses, Filter.....Offer numerous features: lowest cost per sq. ft. of filtering area; produce perfect clarity of filtrate; can be used in decolorizing—deodorizing; etc. Request illustrated Catalog No. 55.
BL329a *T. Shriver & Co.

Process Equipment, Fabricated.....For your most efficient means to fast, economical production, for individualized equipment designed & constructed to fit your needs, request a copy of Koven's Bulletin 550.
41 *L. O. Koven & Bro.

Process Systems.....Allis-Chalmers process system converts fine particles into granular product to meet consumer demand. For complete information, company offers a detailed reference, Bulletin No. 25C6177J.
293 *Allis-Chalmers Mfg. Co.

Processing Equipment.....Describes corrosion-resistant processing equipment . . . precision built to your specific requirements to give long years of peak performance with low maintenance. Technical Bulletins.
314 *Lee Metal Products Co.

Propellers.....Data Folder describes smooth, vibrationless propellers for stirring, mixing, aerating, etc. Balanced to avoid whip and strain on shafts. In a wide variety of metals, and in sizes up to sixty inches.
TR396 *Michigan Wheel Co.

Pulverizers.....The new Mikro-Multi-D pulverizer has been designed for any processing system in which purity of the product is of prime importance. Request a copy of Mikro-D Bulletin & Test Grinding Data Sheet.
281 *Pulverizing Machy. Div.

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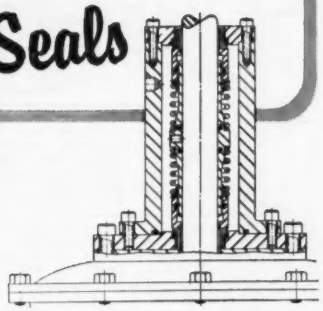

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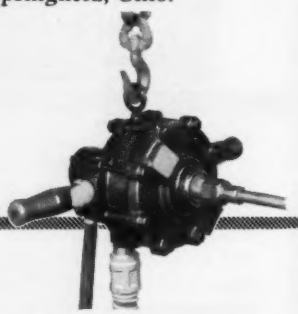

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LITERATURE . . .

Pulverizers.....Valuable data on Superfine pulverizer . . . a centrifugal air attrition impact pulverizer and classifier in a single unit. Covers numerous features, specifications, construction, etc. Illustrated.
304 *Schutz-O'Neill Co.

Reactors, Glassed Steel.....Larger size reactors are now equipped with an 18" diameter round manhole, & the manhole has been moved nearer the side of the reactor. For more complete information, request Bulletin 926.
454a *Pfaudler Co.

Reclaimer Systems, Oil.....A simple, economical and efficient method of restoring contaminated lubricating and sealing oil to the full value of new oil. Offers full details on reclaimers in Bulletin R-160.
318 *Hilliard Corp.

Shell-Ice Makers.....If you need broken ice for any purpose—process work, storage, food service or shipping—the facts about Shell-Ice will pleasantly surprise you. Request copy of Frick Bulletin No. 54.
404 *Frick Co.

Tables, Concentration.....Separate materials into bands & handle coarsest sands with excellent results. Ideal for separation of groups of particles having similar range of specific gravities. Bulletin T1-B3.
R445h *Denver Equipment Co.

Pumps, Blowers, Compressors

Exhausters, Rubber-Lined....."Buffalo" rubber-lined exhausters last from 3 to 12 times longer than ordinary metal fans handling fumes containing corrosive materials. Furnishes details in Bulletin No. 2424F.
46 *Buffalo Forge Co.

Fans.....American Blower offers two references describing their Ventura fans. Request Bulletin No. 6514 for Model K Ventura fan, and for Model G, Bulletin No. 6414 gives complete performance data.
66 *American Blower.

Pumps.....Taber pumps are built for handling chemical solutions, efficiently & economically . . . in the processing industries. Details on horizontal pumps in Bulletin C-355, & for vertical pumps request Bulletin V-837.
L411 *Taber Pump Co.

Pumps.....Ingersoll-Rand motorpumps have well-balanced impellers and precision machined parts help provide peak performance and smooth operation on every job. Request the latest Motorpump Catalog for details.
305 *Ingersoll-Rand

Pumps.....Handle most anything that can pass thru a pipe, from free-flowing liquids to non-pourable pastes—even materials containing relatively large particles or abrasives. Moyno Pump Bulletin No. 30-CE.
68 *Robbins & Myers.

Pumps.....New fully illustrated booklet contains the construction features of the "ACAP" pump for handling solids in suspension under variable capacity and head conditions. "ACAP" Pump Bulletin 08B8328.
438A Allis-Chalmers Mfg. Co.

Pumps, Boiler Feed.....Buffalo 2-stage Type RR Pump for clear water at high pressures, any temperatures. Used successfully on boiler feed for many years. For complete information, request Bulletin No. 980.
420b *Buffalo Pumps.

Pumps, Centrifugal.....Covers the Electri-Cand pump—the answer to a pressing need for handling liquids without leakage. Includes details of outstanding features, a complete parts list, etc. Reference No. SN-54.
438B Allis-Chalmers Mfg. Co.

*From advertisement, this issue

Pumps, Centrifugal . . . . . Impervious graphite pumps feature mechanical seal with enclosed coolant, rugged type SN armored connections, interchangeable parts, wide capacity range, etc. Catalog Section S-7250.
219a *National Carbon Co.

Pumps, Centrifugal.....Describes Warren-Quimby Centrifugal Pump, Type "G", for process and medium-duty chemical service. Capacities up to 400 gpm—heads up to 240 feet. Request illustrated Bulletin No. WQ-213.
439A Warren Steam Pump Co.

Pumps, Centrifugal.....Original manufacturer of self-priming centrifugal pump offers data on new Type CG LaBour—operates under positive or negative suction lift conditions as required. Request Bulletin G-1.
231 *LaBour Co.

Pumps, Centrifugal.....From impeller to shaft seal . . . Weinman pumps are built better. The built-in quality adds up to cost-saving, pumping efficiency for every job. Request descriptive product Bulletins.
307 *Weinman Pump Mfg. Co.

Pumps, Centrifugal.....Easily adapt to changing conditions & demand, save power, combat corrosion & erosion. Speeds, 1750 & 3500 rpm; capacities to 600 gpm; heads to 300 ft. Request latest product literature.
418 *Ampco Metal.

Pumps, Centrifugal.....Meet strict process requirements . . . with Eastern centrifugal pumps. New catalog contains engineering data, performance charts, diagrams & helpful general information. Bulletin 110F.
99 *Eastern Industries.

Pumps, Centrifugal, Sealless.....New design features of leakproof "canned" pumps extend applications & slash price 20–25%. Offers mass production techniques & little maintenance. Request Bulletin No. 1030.
160 *Chempump Corp.

Pumps, Chemical.....Furnishes a complete line of Buffalo pumps, ready to handle corrosive or abrasive liquids at least maintenance cost. For full product information, request illustrated Bulletins 976 and 982.
420d *Buffalo Pumps.

Pumps, Chemical.....Offer new features that make them rugged, dependable, long-lived pumps for handling corrosive liquids. In 9 sizes providing capacities up to 720 gpm & heads up to 200 ft. Bulletin 725.4.
226 *Goulds Pumps.

Pumps, Close-Coupled.....Feature the "Q" Factor . . . the built-in quality which provides trouble-free satisfaction and long life. Offers complete description of Class CCL close-coupled pumps in Bulletin 975-D.
420e *Buffalo Pumps.

Pumps, Controlled Volume.....Illustrated booklet describes motor driven controlled volume pumps with instrument air stroke length adjustment. Covers application, features, operation, etc. Request Bulletin No. 955.
439B Milton Roy Co.

Pumps, Double Suction.....Hydraulically balanced, highly efficient and durable. In sizes to deliver from 10 to 14,000 gpm for circulating, air conditioning, other plant services. Details in Bulletin No. 995-Q.
420a *Buffalo Pumps

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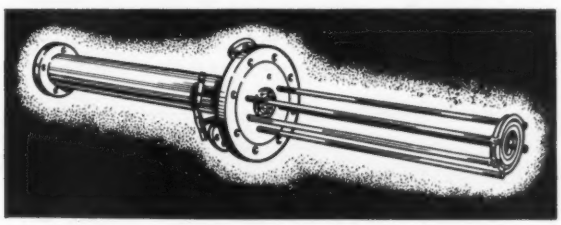

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LITERATURE . . .

Pumps, Loader.....There is an Alemite loader pump to fit any standard container you normally use. For complete details, request your copy of Booklet just released, "5 Plans for Better Lubrication."
101 *Stewart Warner Co.

Pumps, Paper Stock.....For handling high consistency liquids—save money and trouble with non-clogging paper stock pumps. Available in alloys or rubber-lined for corrosive and abrasive liquids. Bulletin No. 953.
420e *Buffalo Pumps.

Pumps, Positive Displacement.....A report on recent findings with respect to the physical and chemical characteristics of non-metallic impellers for displacement pumps is set forth in a new illustrated Folder.
440A Eco Engrg. Co.

Pumps, Propeller.....Lawrence propeller or axial flow pumps are widely used to circulate large volumes of liquid or slurry against low heads as in evaporators, crystallizers, etc. Details in Bulletin 203-6.
407 *Lawrence Pumps.

Pumps, Proportioning.....Describes Model 1105 Adjust-O-Feeder . . . designed for pumping petroleum chemical and boiler feed water additives in accurate predetermined quantities. Bulletin 1105-2.
440B Proportioneers, Inc.

Pumps, Rotary.....The best answer to your pumping problems is a Roper rotary pump and . . . there is a type for you. Roper makes available descriptive literature on its line of pumps. For information, request Bulletins.
416 *Geo. D. Roper Corp.

Pumps, Rotary.....A new line of stainless steel rotary pumps for corrosive solutions, abrasive slurries & fluids which must be kept free from contamination has been announced by Vanton. Full details in Bulletin VP561.
289 *Cooper Alloy Corp.

Pumps, Rotary.....New 40 p. Engineering Manual includes Viking rotary pump fundamentals, the 10 steps in selecting a Viking pump, & a special section to help you choose the right rotary for your job. Manual K c.
TL325 *Viking Pump Co.

Pumps, Vacuum, Steam Jet.....Profusely illustrated, 12 p. describes both condensing & non-condensing two-stage units. Covers applications, features, construction materials, operation, etc. Request Bulletin No. 5H2.
440C Schutte & Koerting Co.

Pumps, Vertical Turbine.....Tested & proved in thousands of installations of all types, Layne pumps lead the field in performance. To know the reason why, request your copy of Product Bulletin No. 100.
37 *Layne & Bowler, Inc.

Services, Processes, Misc.

Apparel, Industrial . . . . . Super-Tough hats & caps provide you that extra protection—both external & internal. Full story on revolutionary, scientific advance in head protection in new Manual.
332 *Willson Products.

Autopositive Paper.....Describes Kodagraph autopositive paper—the "big new plus" in engineering drawing reproduction. "New Short Cuts & Savings" shows all the ways you can save with autopositive paper.
83 *Eastman Kodak Co.

Coordinated Precision Technology..... The highly advanced technological products designed & manufactured by 18 producing companies of GPE Corp. serve more than a dozen major industries. Request Brochure.
248-9 *General Precision Equip. Corp.

*From advertisement, this issue

Copying Equipment.....12 p. Brochure describes the versatility of xerography in preparing masters for offset, diazo, spirit and other fluid-type duplicating. Illustrates full line of XeroX copying equipment.
441A Haloid Co.

Engineering Services.....Help protect your equipment investment—application engineering, analytical engineering, product development, field-service engineering, maintenance service, etc. Bulletins GED-2244 & GED-1966 B.
206-7 *General Elec. Co.

Flotation.....More large plants are installing "Sub-A's" for entire flotation job, because they give maximum recovery at a low cost per ton. Dependable, simplified continuous operating. Bulletin No. F10-B81.
R445g *Denver Equipment Co.

Grating & Stair Treads.....Blaw-Knox electroforged steel grating makes every step a safe step indoors or outdoors. Makes available new reference & quotations. For more complete information request Bulletin 2486.
408 *Blaw-Knox Co.

Laboratory Equipment.....Batch and continuous test models of crushers, screens, ball mills, pulverizers, rod mills, classifiers, agitators and mixers, pulp distributors, feeders, etc. Data in Bulletin LG3-B10.
R445i *Denver Equipment Co.

Laboratory Equipment.....Investigate Sturtevant equipment for your laboratories. They will help you cut sampling cost—improve product quality—increase sales. For complete data, request illustrated Bulletin.
349 *Sturtevant Mill Co.

Laboratory Equipment.....Issues a new edition of "What's New for the Laboratory"—25th in the series. Covers portable air compressors, Dalin condensers, Corning pipettes, humidity apparatus, etc. Illustrated.
441B Scientific Glass Apparatus Co.

Plants, Nitric Acid.....You are assured substantial savings in capital investment and in operating costs when you specify Girdler. Request your copy of the valuable Bulletin on Girdler nitric acid plants.
2 *Girdler Co.

Processes, Steam-Pyrolysis.....Process allows refiner to dispose of marginal products by economically converting natural gasoline, residuals or other low value materials to ethylene and olefins. Illustrated, 8 p.
441C M. W. Kellogg Co.

Reformate Production.....The economic advantages of Kellogg naphtha reforming process using Sinclair-Baker platinum catalyst for production of low cost, high octane reformates are described in illustrated, 8 p.
441D M. W. Kellogg Co.

Research & Development.....“Scientific Analysis of Flavor & Odor” tells how Evans can work for you in developing new products, in controlling the processing of existing products to assure uniformity, etc.
441E Evans Research & Develop.

Safety Devices.....New Wind-Kor automatic safety device permits free movement yet provides absolute safety for workers on jobs where falls are hazards. Offers complete details, test reports and illustrated literature.
441F Wind-Kor Automatic Safety.

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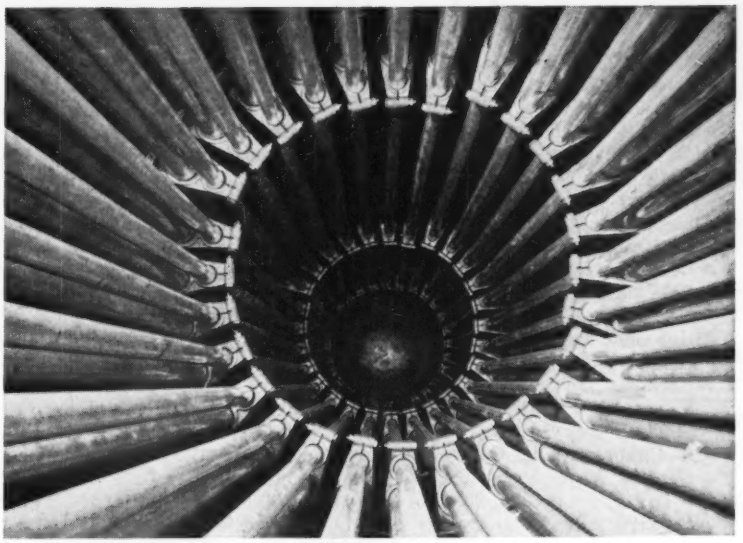

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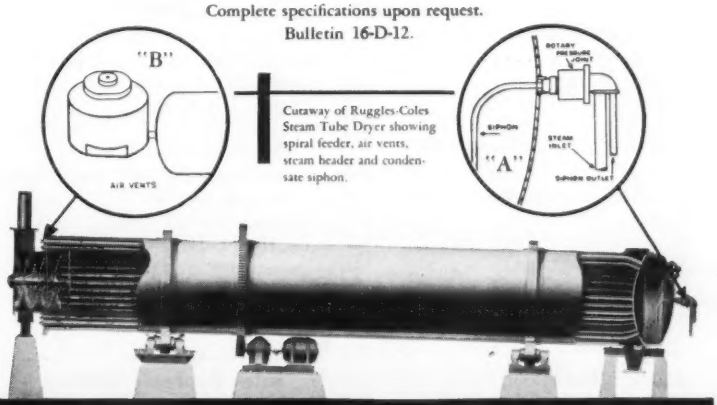
Bulletin 16-D-12.



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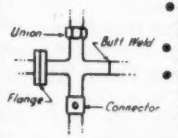

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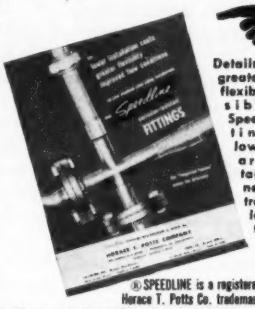

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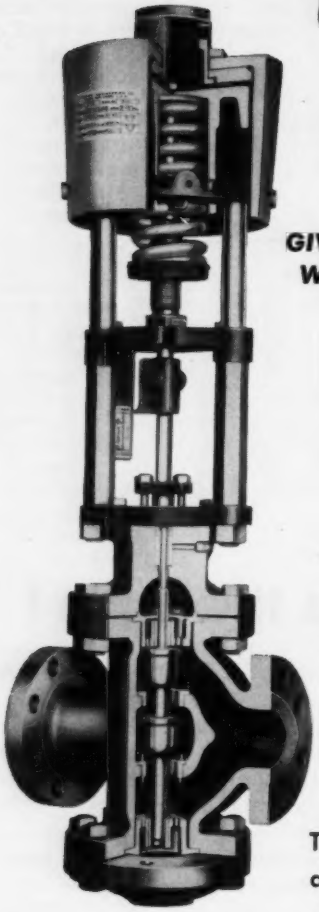

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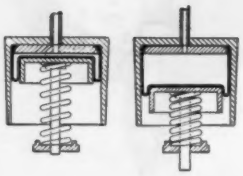

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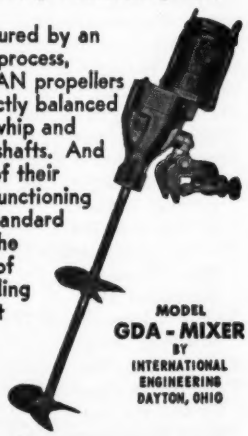

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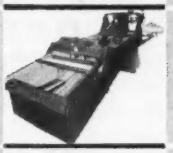
DENVER CLASSIFERS		18" to 60" Wide Suitable Length	Denver Rake Type Classifiers are available in sizes from 1'-6" x 14'-8" to 8' x 21'-8". Denver Spiral Classifiers range in size from 6" x 3'-8" to 60" x 33'-4". Denver Hydra Classifiers are available in diameters from 6' to 55'. All are designed to efficiently separate fine particles in specific applications. Please write for bulletin No. C5C-B.
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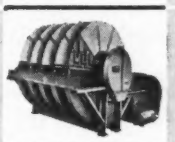
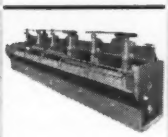
DENVER Disc **FILTER**		1 Disc, 2' to 8 Disc, 6'	Special, patented design of segments in Denver Disc Filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, with no blow-back. Simple, low-cost, dependable construction. Quick delivery. Also Drum and Pan Fillers. Please write for Bulletin No. F9-B2.
DENVER "Sub-A" **FLOTATION**		Laboratory and Commercial	Flotation is the selective separation of particles from each other in a liquid pulp by means of air bubbles. More large plants are installing Denver "Sub-A's" for their entire flotation job, because they give maximum recovery at a low cost per ton. Dependable, low-cost, simplified continuous operation. Please write for Bulletin No. F10-B81.
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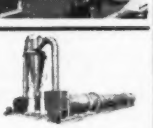
DENVER Standard **DRYERS**		2'x 15' to 5'x 40' and larger	Available in several types: Direct Heat, Indirect Heat, and Steam Tube. Let DECO Engineers solve your drying problem. No dryer problem too small or too large. Please write for Bulletin No. D4-B2.

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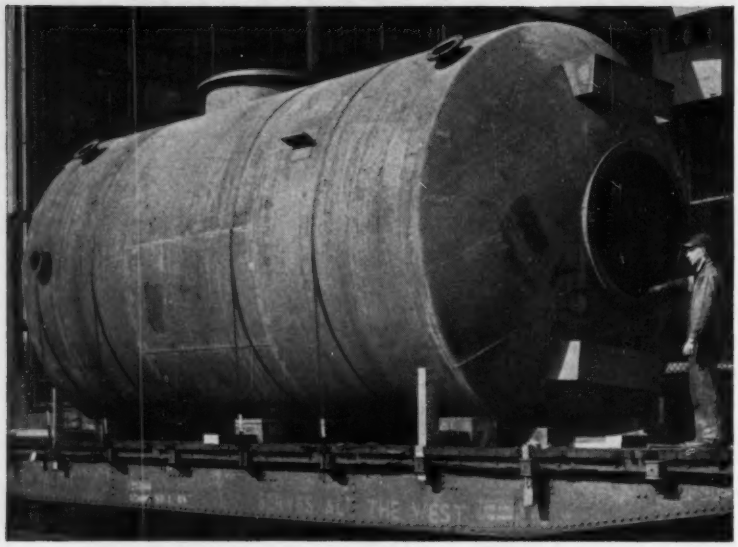

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In these towers, Knight engineers used steel shells lined with PYROFLEX sheet membrane that resists thermal decomposition. Over this membrane goes insulating and acid brick bonded in Knight's High Temperature Cement. Knight Towers give superior performance because:

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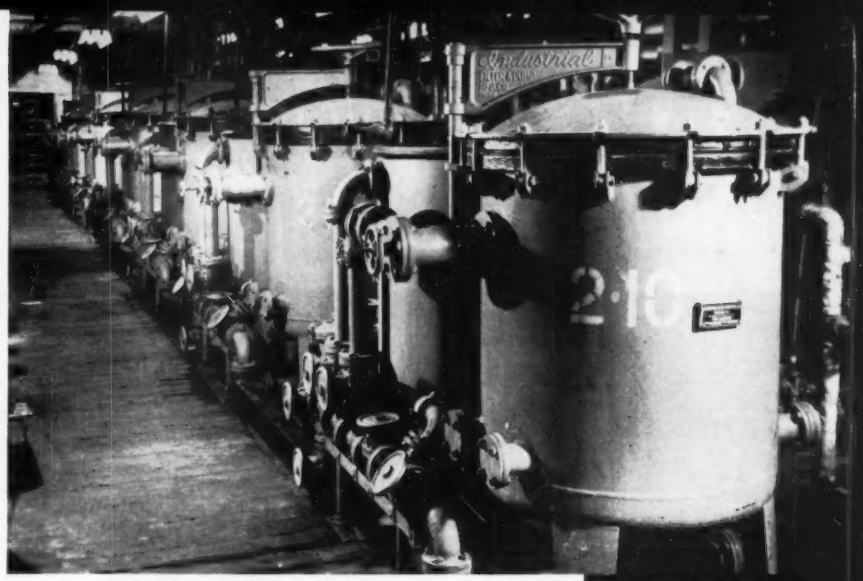

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Easily adapted for special uses . . . these Vertical Filters typify Industrial engineering . . . purposely designed to be built for your exact needs.
Several of the many possible modifications are shown at the right . . . for recovery of large volumes of solids the botiom opening filter is ideal; for smaller volumes, the clean out door is more practical and less costly. Another example of specialization is the jacketed shell filter, for use where small temperature variations are important. Other optional features are quick-opening covers, individual leaf outlets and self-cleaning devices that offer sluicing, shaking or air wash cleaning.

Lower filtration cost . . . proven performance, minimum down time, the use of low cost but efficient filter media plus a design exactly suited to your needs, all contribute to Industrial's low over-all cost per gallon of filtrate.

Write now for details on flow systems, special equipment, filter and leaf construction. Ask for 8 page Bulletin 111. →

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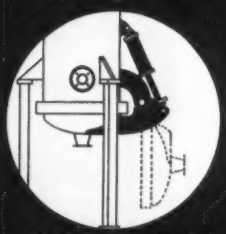
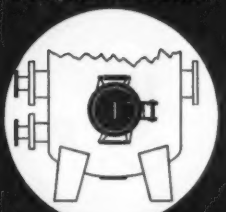
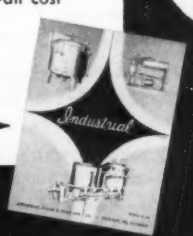


RECOVERING LARGE VOLUMES OF SOLIDS



RECOVERING SMALL VOLUMES OF SOLIDS

JACKETED SHELL FOR UNIFORM TEMPERATURE



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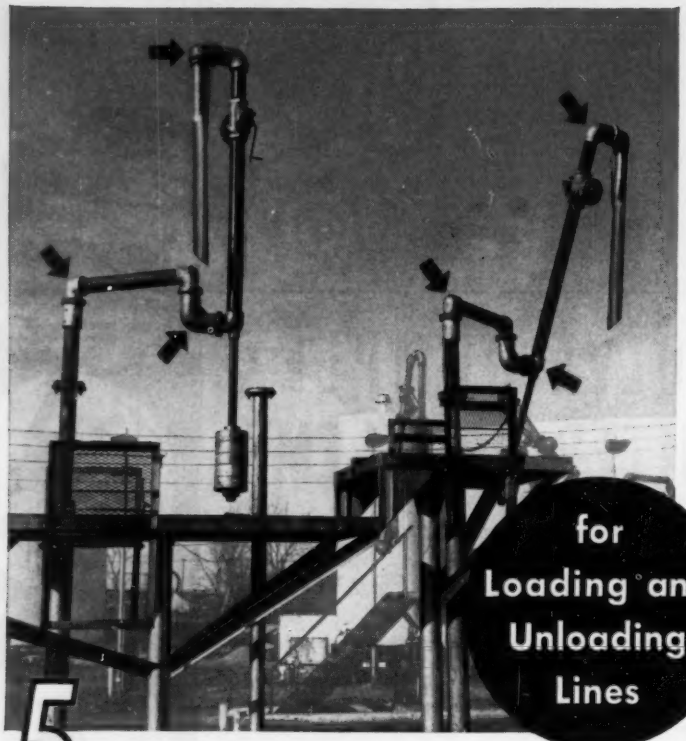
BARCO Swing Joints and Assemblies



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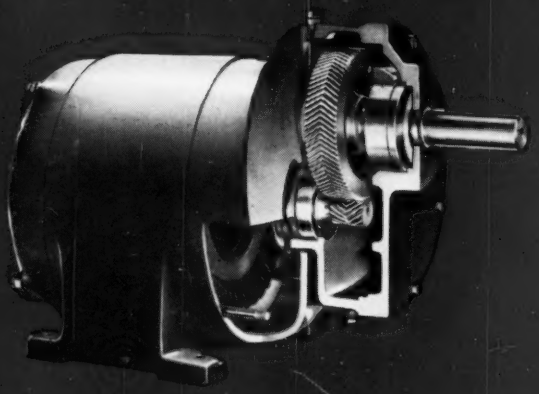

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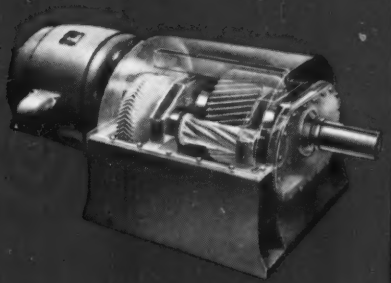
...And that's why more gearmotors carry the Master name than all other makes combined. Write on your business letterhead for details.



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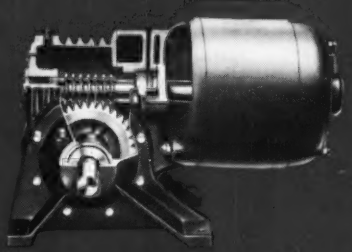


SINGLE REDUCTION
Right Angle Shaft Type

THE MASTER ELECTRIC COMPANY
Dayton 1, Ohio

Corrosioneering News

Quick facts about the services and equipment Pfaudler offers to help you reduce corrosion and processing cost.

New trailer-tank saves time and money with liquid transfer

Liquid shipment eliminates drying and packaging, saves the cost and trouble of returning your product to a liquid state upon arrival.

You can now ship, in liquid form, solutions of all acids except hydrofluoric, and all alkalies up to pH 12, to 212° F.

The new Pfaudler glassed steel trailer-tank is delivered complete with signals, reflectors, and hydraulically operated stand wheels to support it independently.

The tank itself is tough Pfaudler glassed steel. This material, besides being especially economical and corrosion resistant, proves ideal for a mobile tank of this type because of its physical strength. In actual demonstrations, a 36" strip of glassed steel can be flexed 6" in either direction without damaging the glass. This is plenty of "give" to absorb the bumps of the road.

The Pfaudler trailer-tank is equipped with sliding hood to protect the vent, manhole and dip pipe at the top. Dip pipe for filling or emptying, glassed both sides and tantalum tipped, reaches down into sump at bottom of tank to assure complete emptying. Tank also has convenient bottom outlet for washout.

For additional details, call your Pfaudler representative or send for Data Sheet 29.

"Performance" takes driver's seat as basis for selecting equipment

Why Pfaudler created new engineering group

John W. Cosier

To *simplify* selection of equipment that will *perform* as required to obtain desired yields, Pfaudler has established an Applications Engineering Group.

This section, working with design, development, research and production groups, studies each customer's exact production needs, and selects or designs the proper equipment to match these requirements.

Thus, you have even greater freedom from mechanical restrictions than ever before, since each unit of equipment is carefully chosen to provide the yield you want.

This new group of selected engineers—with extensive backgrounds in chemical production problems—is headed by John W. Cosier.

Pfaudler's Applications Engineering Group has four fields of information at its fingertips:

1. Specialized knowledge of all types of glassed steel, stainless and alloy vessels.

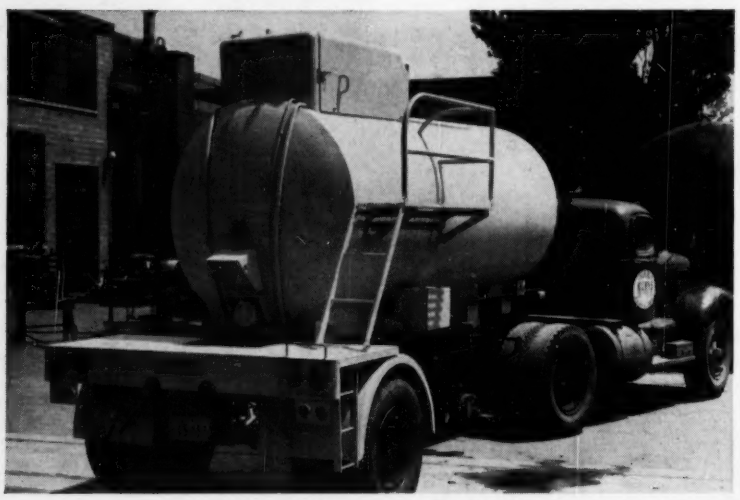
2. Pfaudler's 72 years of experience in corrosion-resistant equipment.

3. Experimental, test and user data, compiled in Pfaudler's corrosioneering library.

4. Personal experience of each member of the group.

Pfaudler has already had much experience supplying equipment on a performance basis for: absorption, centrifugation, crystallization, distillation, drying, evaporation, liquid extraction, filtration, flow of fluids, leaching, materials handling and mixing. May we help you?

Example of a Pfaudler application and project engineering: The 25 glassed reactors in this large PVC plant are specially equipped for high internal pressures.



Glassed steel trailer-tank is corrosion resistant, permits low-cost shipment of materials in liquid state.

New reactor manhole is bigger, handier

Reaction kettles by Pfaudler in larger sizes are now equipped with an 18" diameter round manhole, compared to the old elliptical 12" x 16" opening.

Also, the manhole has been moved nearer the side of the reactor.

This new manhole not only offers a portly portal for hefty chemical workers (up to size 56!) but also provides easier visual inspection and cleaning, and a safer angle for positioning ladders.

For details of this and other design improvements in the New Pfaudler reactors, call your Pfaudler representative or write for Bulletin 926.

Pfaudler

THE PFAUDLER CO., ROCHESTER 3, N. Y.